FIRST

ANNUAL REPORT

OF THE

State ÷ Inspector ÷ of ÷ Mines

TO THE GOVERNOR

OF THE

STATE OF WEST VIRGINIA,

FOR THE

YEAR 1883.

WHEELING:
CHAS. H. TANEY, STATE PRINTER.
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DEGO, KANAWHA CO., W. VA., June 30, 1884.

To His Excellency, JACOB B. JACKSON,

Governor of West Virginia:

SIR:—In compliance with the ninth section of an Act of the West Virginia Legislature, passed February 22, 1883, entitled "An Act regulating the working and proper ventilation and drainage of Coal Mines, and providing for the appointment of a Mine Inspector," I have the honor of submitting to you my First Annual Report, as Inspector of Mines, for the year 1883.

Section nine of the above named Act states that: "It shall be the duty of such Inspector of Mines, on or before the first day of January in each year, to make a report to the Governor of his proceedings as such Inspector, and of the condition of each and every mine in the State, which has been operated more than two months preceding the date of his report, and stating therein all accidents that may have happened in the working and operating of said mines, the number of persons, if any, who have been injured or killed, the cause thereof, so far as he has been able to ascertain, and all the facts at his command in relation thereto. He shall also make such suggestions and recommendations in relation to said mines, and the proper legislation relating thereto, as he may deem proper and necessary."

I did not make my first annual report, for the year 1883, on the first day of January, 1884, for the reason that I had not at that time inspected all the coal mines in the State; and for the further reason that I deemed it of much more importance and more in accordance with the intention of the mining law, to continue inspecting the

mines, and endeavoring to get the same in proper condition as to ventilation and drainage, than to make a report, at that time, upon the condition of the mines so far inspected. My action in this matter I trust has met with your approval.

I did not begin to inspect the mines until the first day of September, 1883, because the mining law came into full force and effect at six months from the passage of the act, as may be seen by reference to sections three and five; although a note, at the end of the act, by the Clerk of the House of Delegates, reads: "The foregoing act takes effect at the expiration of ninety days from its passage."

I determined upon the following route as the one I would follow in my tour of inspection, viz: to begin at Raymond City, the most westerly mine on the great Kanawha river, and work thence eastwardly, inspecting each mine in its regular order of succession, to Quinnimont on New river, in Fayette county; thence to Piedmont in Mineral county, and from there westwardly along the Baltimore and Ohio railroad and the Parkersburg branch of the same until I should have visited all the mines on that portion of said railroad; thence northwardly, from Grafton, along the main stem of the Baltimore and Ohio railroad to Wheeling, and up the Ohio river to all the mines in the "Panhandle;" thence down the Ohio to the mines in Mason county.

This course I pursued, with the exception of a few mines on the Kanawha, which were idle at the time of my inspection in that region, and were therefore skipped to be inspected later. There was quite a newspaper "racket" in January, 1884, over what was *supposed* to be my neglect of duty, as I had not, at that time, gotten to the mines of the upper portion of the State. It was probably not then known that the *largest* coal producing district of the State was the Kanawha region, and that it took *more* than a *little work* to get the mines *there* in something like a decent condition.

However, I do not blame the miners of the upper portion of the State for their complaints; in many of the mines there was just cause for it. But, as I learned, while in that district, a great deal if not the *greatest* part of the complaint, about the negligence of the Inspector, came from parties who failed to secure the appointment to the position of Inspector of Mines. If a great many persons who applied for this position had read the first section of the mining law, they might have saved themselves a great deal of trouble and useless waste of time, as the section referred to states, that, "the Inspector of Mines shall be a *Mining Engineer*," and I know of no person, who was an applicant for the position, except myself, that "filled the bill" in *that particular*, although I have no doubt there

were *many* more competent for the duties of the office, (in their own opinion, at *least*).

In the body of this report will be found a description of each mine in the State and of the condition of the same as to ventilation, drainage, etc.

I have endeavored to get an accurate statement of the total coal and coke production of the State, and also a statement of the number of persons employed as miners and otherwise in and about the mines, by mailing to each coal operator a blank report* which I requested them to fill out and return to me; the majority of the operators complied very readily, and so far as I know, cheerfully; others however could not be moved to report without a great deal of persuasion and my assurance that the figures given of their coal output would be treated *strictly confidential* and be used for the sole purpose of arriving at the total production of the State and districts. Still quite a number have failed to report, and in several cases I have consequently been obliged to *estimate* the output of the mine; this, however, has been done with great care, and has been arrived at by estimating the output of a mine which did *not* report by the number of miners employed, first, having determined the number of tons of coal produced per miner per annum as deduced from the output of some neighboring mine which *reported* the quantity of coal mined during the year. I can, therefore, confidently state that my summary of the coal production of the State and of the various districts therein is as accurate as it is possible to make it, under the circumstances. I am under many obligations to Mr. C. W. Smith, the General Manager of the Chesapeake and Ohio railway, who kindly furnished me a statement of coal and coke shipped east and west over the C. & O. railway from the New River district and from the Kanawha district; and also for an *approximate* division of the shipments, showing how much of each kind of coal, (cannel, gas, splint and New River steam) was transported.

In the back of this report are tables of various kinds which give, in a better form for comparison and easy comprehension the information that is often detailed and disconnected in the body of Mine Inspectors' reports. In these tables are given the distances to market, east and west, the elevations of the mouths of the mines, the names of the coal seams in which the mines are operated, the thickness of the coal seam and a great deal of other information which will, no doubt, be of interest and utility to all parties interested in the coal business.

That the public may have some *idea* of the work to be done by

*A copy of this blank form or report is shown at the end of this report.

an Inspector of Mines for the State of West Virginia, as the law now stands, I submit the following:

1st. There are about one hundred mines "in which fifteen or more persons are engaged as miners," and consequently these mines must be "inspected once a year or *oftener* if necessary."

2d. The Inspector must be furnished an accurate map of each of these mines, showing the progress of said mines to the first days of January and July of each year. If such maps are not furnished by the operators of the mines, it is the duty of the Inspector to make such maps or have them made, and if the operator refuse to pay for the same, the Inspector has then to sue the operator for the amount of his bill for making or having such maps made.

3d. After inspecting a mine, and then carefully studying the maps of it, the Inspector must give written instructions to the operator as to what is necessary to be done in order to remedy any defects that may have been found in the ventilation, drainage or safety of said mine.

4th. The operator having been given a reasonable time, in which to comply with the instructions of the Inspector, he must again visit the mine to see whether or not his instructions have been complied with.

5th. If the Inspector finds that his instructions have not been complied with, or that the mine is not well ventilated, or not well drained, or that there is any dangerous pieces of roof on the entries that are not securely propped, or that there is not "kept at or near the entrance to the mine, a sufficient amount of timber, of the proper size and kind, to be placed therein, whenever it may be necessary, to secure any loose rock or coal overhead, in any part of said mine, which may be in use, so as to prevent injury to the persons working therein," then the Inspector must go before the grand jury of the next circuit court of the county, in which the mine is situated, and indict the operator of such mine for violation of the law on any or all the above points of which he may be culpable.

6th. And last but by no means least, the Inspector must make an annual report to the Governor, "of his proceedings, as such Inspector, and of the condition of each and every mine in the State, which has been operated for more than two months preceding the date of his report, and stating therein all accidents that may have happened in the working and operating of said mines, the number of persons, if any, working in and about said mines, who have been injured or killed, the cause thereof, so far as he has been able to ascertain and all the facts at his command in relation thereto. He shall also make such suggestions and recommendations in rela-

tion to said mines, and the proper legislation relating thereto, as he may deem proper and necessary."

I shall not, in this report, make any "suggestions as to the proper legislation relating to the mines" of West Virginia, but will submit to your Excellency a special report on that subject in time for the same to be embodied in your message to the next Legislature.

I would most earnestly recommend that there be at *least* eight hundred copies of this report printed so as to have enough of them to place one in the hands of every tenth miner in the State, and give one to each superintendent, and one to each mine boss, and have about one hundred over for general distribution. If a thousand copies were printed it would be much better.

It is to be *hoped* that the proper pains will be taken by the printer to avoid typographical errors, and especially in the printing of the tables accompanying this report.

Respectfully submitted,

OSCAR A. VEAZEY,
Inspector of Mines.

DIVISION OF THE STATE INTO DISTRICTS.

On the Kanawha river and its main tributary, the New river, there are sixty-three mines, which are widely separated from the mines elsewhere in the State, except those in Mason county on the Ohio river. I have, therefore, in this report, denominated all that mining region which is drained by the waters of the Great Kanawha river as the "Kanawha District;" while the region north of this district, which includes all the mines on the Baltimore and Ohio railroad and on the Ohio river, I have termed the "Northern District."

The distance, in a direct line, between the central points of the two districts, viz: Cannelton and Grafton, is about one hundred and five miles. Between the most widely separated mines of the two districts, viz: Quinnimont in Fayette county and Wellsburg in Brooke county, the distance in an air line is about one hundred and seventy-five miles.

STATISTICS

Of Coal Production, Number of Employees, Fatal and Non-Fatal Accidents, Etc., for the Year 1883.

KANAWHA DISTRICT.

COAL AND COKE PRODUCTION.

(Tons of 2240 pounds.)

Actual coal production of 46 mines, as per reports of operators		1,460,324
Estimated production of 8 mines, from which no reports were received		156,456
Total coal production of the district as per reports and estimated quantities, for 54 mines		1,616,780
Quantity of coal shipped out of the State by railroad, east		717,280
Quantity of coal shipped out of the State by railroad, west		38,792
Total quantity of coal shipped out of the State by railroad		756,072
Quantity of coal shipped out of the State by river, west		558,291
Total quantity of coal shipped out of the State		1,314,363
Quantity of coal shipped to points in the State		36,516
Quantity of coal used about the mines and for domestic purposes		21,147
Quantity of coal used in the district by iron works	47,568	
Quantity of coal used in the district by salt furnaces	15,179	
Quantity of coal used in the district by manufactories of all kinds		62,747
Total quantity of coal produced by the district, used in the State		120,410
Quantity of coal coked		225,571
Quantity of coke produced		139,133
Quantity of coke produced by the district, used in the State		30,065
Quantity of coke shipped out of the State		109,068

EMPLOYEES.

Number of miners employed	2,962
Number of other inside employees	519
Total number of inside employees	3,481
Number of outside employees	681
Total number of persons employed in and about the mines	4,162
Number of mules and horses employed in and about the mines	409

CASUALTIES.

Number of casualties in the mines	30
Number of casualties outside the mines	1
Number of casualties in and about the mines	31
Number of fatal casualties in the mines	12
Number of fatal casualties outside the mines	1
Number of fatal casualties in and about the mines	13
Number of non-fatal casualties in the mines	18
Number of non-fatal casualties outside the mines	0
Number of non-fatal casualties in and about the mines	18
Number of deaths from falls of coal	3
Number of deaths from falls of roof	8
Number of deaths from wrecks of mine cars on railroad outside the mine	1
Number of deaths from mine cars in the mines	1
Number of non-fatal injuries from falls of coal	5
Number of non-fatal injuries from falls of roof	6
Number of non-fatal injuries from mine cars	3
Number of non-fatal injuries from other causes	4

PROPORTIONS.

Number of tons of coal produced per life lost	124,368
Number of tons of coal produced per non-fatal accident	89,821
Number of tons of coal produced per casualty	52,154
Number of tons of coal produced per miner employed	580
Average earnings per miner at 70 cents per ton	$406
Number of miners employed per life lost	228
Number of miners employed per non-fatal accident	165
Number of miners employed per casualty	95½

NORTHERN DISTRICT.

Actual coal production of 43 mines, as per reports of operators	1,088,696
Estimated production of 21 mines, from which no reports were received	100,089
Total coal production of the district as per reports and estimated quantities, for 64 mines	1,188,785

Quantity of coal shipped out of the State by railroad, east		531,705
Quantity of coal shipped out of the State by railroad, west		67,782
Total quantity of coal shipped out of the State by railroad		599,487
Quantity of coal shipped out of the State by river, west		67,426
Total quantity of coal shipped out of the State		666,913
Quantity of coal shipped to points in the State		84,240
Quantity of coal used about the mines and for domestic purposes		126,828
Quantity of coal used inside the State by iron works	191,883	
Quanty of coal used inside the State by glass works	7,270	
Quantity of coal used inside the State by salt furnaces	61,370	
Quantity of coal used inside the State by manufactories all kinds		260,523
Total quantity of coal used inside the State		471,591
Quantity of coal coked		52,964
Quantity of coke produced		31,205
Quantity of coke used in the State		12,951
Quantity of coke shipped out of the State		18,354

EMPLOYEES.

Number of miners employed	1,476
Number of persons, not miners, employed in the mines	386
Total number of persons in the mines	1,862
Number of persons employed outside the mines, in connection therewith	370
Total number of employees in and about the mines	2,232
Number of mules and horses employed in and about the mines	340

CASUALTIES.

Number of casualties in the mines	19
Number of casualties outside the mines	1
Number of casualties in and about the mines	20
Number of fatal casualties in the mines	7
Number of fatal casualties outside the mines	0
Number of fatal casualties in and about the mines	7
Number of non-fatal casualties in the mines	12
Number of non-fatal casualties outside the mines	1
Number of non-fatal casualties in and about the mines	13
Number of deaths from falls of coal	3
Number of deaths from falls of roof	3
Number of deaths from being crushed between mine cars and side of room	1
Number of non-fatal injuries from falls of coal	4
Number of non-fatal injuries from falls of roof	3
Number of non-fatal injuries from mine cars	5
Number of non-fatal injuries from cart upsetting outside of the mine	1

PROPORTIONS.

Number of tons of coal produced per life lost	169,826
Number of tons of coal produced per non-fatal accident	91,445
Number of tons of coal produced per casualty	59,139
Number of tons of coal produced per miner employed	805 4-10
Average earnings per miner at 50 cents per ton	$102.70

Number of miners employed per life lost	210 6-7
Number of miners employed per non-fatal accident	113 7-13
Number of miners employed per casualty	73 4-5

ENTIRE STATE.

Actual coal production of 89 mines as per reports of operators		2,549,020
Estimated production of 29 mines from which no reports were received		256,546
Total coal production of the State as per reports and estimated quantities, for 118 mines		2,805,566
Quantity of coal shipped out of the State by railroad, east		1,248,986
Quantity of coal shipped out of the State by railroad, west		106,574
Total quantity of coal shipped out of the State by railroad		1,355,560
Quantity of coal shipped out of the State by river, west		625,717
Total quantity of coal shipped out of the State		1,981,277
Quantity of coal shipped to points in the State		120,756
Quantity of coal used about the mines and for domestic purposes		147,975
Quantity of coal used inside the State by iron works	239,451	
Quantity of coal used inside the State by glass works	7,270	
Quantity of coal used inside the State by salt furnaces	76,549	
Quantity of coal used inside the State by manufactories of all kinds		323,270
Total quantity of coal used inside the State		592,001
Quantity of coal coked		278,535
Quantity of coke produced		170,437
Quantity of coke used in the State		43,016
Quantity of coke shipped out of the State		127,421

EMPLOYEES

Number of miners employed	4,438
Number of persons, not miners, employed in the mines	905
Total number of persons in the mines	5,343
Number of persons employed outside the mines, in connection therewith	1,051
Total number of employees in and about the mines	6,394
Number of mules and horses employed in and about the mines	749

CASUALTIES.

Number of casualties in the mines	49
Number of casualties outside the mines	2
Number of casualties in and about the mines	51
Number of fatal casualties in the mines	19
Number of fatal casualties outside the mines	1
Number of fatal casualties in and about the mines	

Number of non-fatal casualties in the mines	30
Number of non-fatal casualties outside the mines	1
Number of non-fatal casualties in and about the mines	31
Number of deaths from falls of coal	6
Number of deaths from falls of roof	11
Number of deaths from wreck of mine cars on railroad outside the mines	1
Number of deaths from mine cars inside the mines	2
Number of non-fatal injuries from falls of coal	9
Number of non-fatal injuries from falls of roof	9
Number of non-fatal injuries from mine cars	8
Number of non-fatal injuries from cart upsetting outside of the mine	1
Number of non-fatal injuries from other causes	4

PROPORTIONS.

Number of tons of coal produced per life lost	140,278 3-10
Number of tons of coal produced per non-fatal accident	90,502 4-31
Number of tons of coal produced per casualty	55,011 1-10
Number of tons of coal produced per miner employed	632 17-100
Number of miners employed per life lost	221 9-10
Number of miners employed per non-fatal accident	143 5-31
Number of miners employed per casualty	87 1-51

STATEMENT OF COAL AND COKE SHIPPED OVER THE CHESAPEAKE AND OHIO RAILWAY DURING THE YEAR 1883.

The following was kindly furnished me by Mr. C. W. Smith, General Manager of the Chesapeake and Ohio Railway:

NEW RIVER DISTRICT.

STATIONS.	COAL.		COKE.		TOTAL.
	East.	West.	East.	West.	Tons of 2,240 Lbs.
Quinnimont	4,222	2,634	1,837	101	8,794
Stone Cliff	6,487	34	8,383	5,507	20,411
River View	17				17
Echo	4,912	1,318			6,230
Fire Creek	55,514	3,948	3,564	16,105	79,131
Sewell	9,541		27,464		37,005
Caperton	96,586	123			96,709
Nuttallburg	40,192	1,372	1,670	13,708	56,942
Fayette	3,043				3,043
Elmo	9,518	1,209			10,727
Hawk's Nest	62,756	90	16,970		79,816
Total	292,788	10,728	59,888	35,421	398,825

KANAWHA DISTRICT.

STATIONS.	COAL.		COKE.		TOTAL.
	East.	West.	East.	West.	Tons of 2,240 Lbs
Eagle	33,833	1,407	1,797	14,764	51,801
Frederick	24,363	1,866	36		26,265
Crescent	12,103	580	14		12,697
Cannelton	377,420	4,472		23	381,915
Paint Creek	19,459	2,878			22,337
Blacksburg	12,088	5,182	11		17,281
Coalburg	23,371	10,251			33,622
Winifrede June	8,670	1,035			9,705
Total	511,307	27,671	1,858	14,787	555,623

Total quantity of coal from New River district	303,516	
Total quantity of coal from Kanawha district	538,978	
Total quantity of coal from both districts		842,494
Total quantity of coke from New River district	95,309	
Total quantity of coke from Kanawha district	16,645	
Total quantity of coke from both districts		111,954
Total quantity of coal and coke from both districts		954,448

Quantity of each kind of coal—	
Cannel coal	18,492
Gas coal	422,552
Splint coal	97,934
New River steam coal	303,516
Coke	111,954
Total	954,448

COAL PRODUCTION OF THE UNITED STATES.

States.	1882. *Tons* (2,240).	1883. *Tons* (2,240).
Pennsylvania, anthracite	29,120,096	31,793,027
Pennsylvania, bituminous	22,000,000	24,000,000
Illinois	9,115,653	10,508,791
Ohio	9,450,000	8,229,429
Iowa	3,127,700	3,881,306
West Virginia	2,000,000	2,805,566
Indiana	1,976,470	2,400,000
Maryland	1,294,316	2,306,172
Missouri	2,000,000	2,250,000
Kentucky	1,300,000	1,650,000
Alabama	800,000	1,100,000
Colorado	947,749	1,100,000
Tennessee	850,000	1,000,000
Kansas	750,000	850,000
Wyoming Territory	631,031	700,000
Washington Territory	225,000	260,000
Utah	250,000	250,000
New Mexico	146,421	250,000
Virginia	100,000	225,000
California	200,000	200,000
Georgia	175,000	200,000
Indian Territory	150,000	175,000
Michigan	130,000	135,000
Texas	.....	100,000
Arkansas	50,000	75,000
Oregon	30,000	60,000
Montana	30,000	50,000
Dakota	.....	50,000
Idaho	.....	10,000
	86,819,436	97,211,284

KANAWHA DISTRICT.

(1.) JEROME CITY MINE,

On the south side of the great Kanawha river, in Putnam county, three and one-half miles below Winfield, and about twenty-nine miles from Point Pleasant, is being opened by J. T. Bowyer, Esq., who owns the land. He expects to reach the coal, with the slope now being sunk, sometime during this summer. The coal seam to be worked is the "Pittsburgh," which here has a thickness of from four and one-half to five feet, and lies about twenty-five feet under the bottom lands, and about twenty feet above low water of the river. There will be from four to four and one-half feet of the seam worked.

About half a mile below, or west of this mine, is the old "Oak Ridge" mine, now idle.

(2.) RAYMOND OR STAR MINE,

Operated by the Marmet Mining Company, of Cincinnati, Ohio, is situated on a branch of the Pocatalico river, a northern tributary of the great Kanawha. The coal is conveyed to the Kanawha over a three and a half feet gauge railroad, three and a half miles long, in centre dump coal cars of seventy-five bushels capacity each. The total output of this mine goes west, by river, to Cincinnati, Ohio. The coal seam worked is what is generally known as the "Pittsburgh," and is a hard bituminous or block coal, here ranging in thickness from three to seven feet, with a geneal average of five feet eight inches.

This is quite an extensive mine, the main entry having a total length of six thousand five hundred and fifty-eight feet. The average dip of the coal seam is N. 12 deg. W., forty-eight feet per mile. The ventilation is maintained by a furnace, arch five feet, internal diameter, and forty feet long, stack thirty-five feet high and four and one-half feet square inside.

The condition of this mine, as to ventilation and drainage, was quite good, at the time of my visit; and the disposition of this company seems to be, to comply with the requirements of the law in every particular. A new ventilating furnace is now being built for the purpose of affording air to the working parts of the mine; the old one is then to be used for ventilating the main haulway.

(3.) PERFECTION MINE,

Operated by the Black Band Iron and Coal Company, is on the head waters of Davis creek. This company during the years 1881 and 1882 constructed a standard gauge railroad from the Chesapeake and Ohio railway and from the Kanawha river up Davis creek 13 4-10 miles to their mines of Black Band iron ore and coal. They have also constructed a small iron furnace on the bank of the Kanawha river at the mouth of Davis creek. The coal seam worked is a hard bituminous or block coal, having very much the appearance of cannel. At the time of my inspection of the mine it was dependent upon natural ventilation, which means *no ventilation* in mines situated as this one is, down in a hollow between the mountains and having but one mouth. I instructed the superintendent by letter as to what should be done in order to get the mine in proper condition, and my instructions have been complied with.

Analyses of the coal, and of coke made from the same, as furnished me by the superintendent:

COAL.		COKE.	
Ash	1.70	Ash	4.98
Moisture	2.21	Moisture	—
Fixed Carbon	57.48	Fixed Carbon	93.88
Volatile Matter	38.58	Volatile Matter	1.14
	100.00		100.00
Sulphur	0.45	Sulphur	0.16
Specific Gravity	1.264		

Test of the coal for gas purposes: One pound of coal yields five cubic feet of gas. Candle power of gas, 18 19-100. Three hundred and seventy-two pounds of coke made from six hundred pounds of coal; yield of coke being sixty-two per cent

(4.) BLACK HAWK MINE,

About three miles above Charleston and on the north side of the Kanawha river, is now being operated by Morris Williams (colored). There are only four or five miners employed.

(5.) BROOKS' MINE,

A short distance above the Black Hawk mine, is operated by M. P. Norman. The output of this mine is used by the Logan salt furnace, near by. As there were only ten or twelve miners employed here the mine was not inspected.

(6.) PIONEER MINE NO. 1

Is operated by the Pioneer Coal Company. The output of this is shipped west, by river, the coal being transported from the mine to the river in the mine cars, over a narrow gauge railroad. The coal is a hard bituminous or block coal, and by some is called a splint coal; this, I think, however, is a misnomer. The

average dip of the coal seam is about northwest, eighty feet per mile. This mine was opened in July, 1871, and is now very nearly worked out. Ventilation is maintained by a furnace, arch three and one-half feet, inner diameter, and twenty feet long, stack three by three and one-half feet inside, and twenty-five feet high. At the time of my visit, this mine was in very bad condition, both as to ventilation and drainage. I instructed the superintendent, by letter, as to necessary improvements, but cannot say whether they were made or not.

(7.) PIONEER MINE NO. 2

Is operated by the same company that runs No. 1, and the coal is hauled and shipped in the same way. The mine was opened in October, 1873, and like No. 1, is very nearly worked out. The condition of this mine was, if anything, worse than No. 1, especially as to ventilation. The furnace was too small, and the return airway choked up with slate and gob to such an extent, that the area through which the air had to pass to the furnace, was only about twenty square feet. The doors and stoppings throughout the mine leaked badly, and hence, what air entered the mine was not carried up to the working faces in sufficient quantity. I instructed the superintendent as to the needed improvements, and on a second visit to the mine, found it in much better condition, thought yet not up to the proper standard. The total force in the mine at this time was eighty-eight persons and fifteen mules, and while there should have been *at least* twelve thousand cubic feet of air per minute in circulation through the workings of the mine, I found only six thousand eight hundred cubic feet per minute, at the intake, and very little more than one-third this quantity at the head of the workings. I carefully examined every stopping and door between the intake and and return airways in the presence of the mine boss, and called his attention to the leakage of air at these points, and instructed him to plaster each and every stopping with clay, so that no place could be found in any stopping that would suck in the blaze of a lamp, and to make his doors as nearly air-tight as possible. I also wrote a letter of instruction to the superintendent, but do not know what the result has been.

(8.) BOYCE MINE

Is operated by the Campbell's Creek Coal Company, who ship their coal by river to Cincinnati, Ohio, where they have an elevator and coal yard. The coal from this mine is transported to the river in the mine cars over the C. C. C. Co.'s standard gauge railroad, which is equipped with two locomotives. The ventilation of this mine which is almost *perfect*, is maintained by a ventilating furnace, arch five feet inner diameter and thirty-five feet long, four feet space over grate bars, stack five feet inner diameter and seventy-eight feet high from top of arch to top of stack; fifty-two feet of this stack is shaft through sandstone and eighteen feet through earth. The general condition of this mine is *very* good.

(9.) CALDERWOOD MINE

Is operated by the Campbell's Creek Coal Company, and the output is disposed of in the same manner as that of the Boyce mine. The system of ventilation and general plan of working which obtains at the Boyce mine is here in vogue, and the condition of this mine is *perfect* in *every* respect. It is a great pleasure to go through *such* a mine, as it is like an oasis in a desert compared to the majority of the mines in this State. The ventilating furnace here has the following dimensions: arch six and one-third feet internal diameter, space above grate bars five feet, length of arch thirty-five feet, stack four feet square inside and forty-two feet high.

(10.) DANA BROTHERS' MINE.

The coal from this mine is transported to the river in four-wheel, centre-dump cars on the C. C. C. Co's railroad, and shipped in barges to Cincinnati, Ohio. Here I found an enormous leakage of air through the doors and stoppings, and as a natural consequence the ventilation was poor; the roads were wet and sloppy. I instructed the superintendent by letter, November 19, 1883. The dimensions of the ventilating furnace, at this mine, are, arch four feet inner diameter and twenty-eight feet long, space over grate bars three feet, stack three feet square inside and fifty-five feet high. This furnace is not sufficiently powerful to maintain the necessary quantity of air for the number of miners that were working at the time of my visit.

(11.) DICKINSON'S FURNACE MINE,

On the north side of the Kanawha river about seven miles above Charleston, is operated by John Quincy Dickinson for the purpose of furnishing fuel for his salt furnace, which is on the bank of the river near the mine.

There being only ten miners employed here, I did not inspect the mine. The coal seam worked is the top band of the "Campbell's Creek," which is divided by a band of slate at the Calderwood mine, and this parting thickens rapidly as the seam is traced up the river.

(12.) BENNINGTON MINE.

The coal from this mine is lowered in the mine cars over an incline plane, to the river tipple, where the coal is transferred to barges and shipped west by river. The coal seam here worked is said to be a part of the Campbell's Creek seam, which splits just above Campbell's creek and the slate parting gets so thick as to prevent the working of the two bands of coal as one seam. At the time of my inspection this mine was ventilated by steam jets, ten in number, which, by blowing through as many iron pipes (about ten inches in diameter) into a wooden stack, created an air-current of five thousand cubic feet per minute. This current of air, however, did not reach the working portion of the mine, which I found sadly in

need of it. The roadways of the mine were very sloppy, and there was one place on the main entry where the roof was dangerous. By letter of November 20, 1883, I ordered all these defects remedied.

(13.) WINIFREDE NO. 1.

This mine is situated on the head waters of Fields creek, and the coal is conveyed from the mines to the river and to the Chesapeake and Ohio railway over the Winifrede railroad, which is owned by the same company that owns the mines. This is a standard gauge railroad, about six miles long, and has been projected to Coal river, which it would strike at the mouth of Joe's creek, making a line about ten or twelve miles long, from the Kanawha river to Coal river. More than nine-tenths of the coal produced from the mines of the Winifrede Coal Company, goes west by river. This company has a substantial river tipple, where the six ton railroad cars are loaded into the barges, and the doors in the bottom of the cars being unfastened, the coal is discharged into the barges. Some of the coal shipped from these mines goes as far as New Orleans, Louisiana. The mine is ventilated by a furnace, and the state of the ventilation, at the time of my visit, was fair, but the drainage was not good, the roads being quite sloppy.

(14.) WINIFREDE NO. 2.

This mine, as well as No. 1, is owned and operated by the Winifrede Coal Company. Both mines are worked on the double entry system, and there is no reason for lack of proper ventilation, unless the rooms are drained too far from the entries, without breakthroughs between them, to admit of the air-current sweeping near enough to the working faces. This mine is also ventilated by a furnace, and was in a fair condition, both as to ventilation and drainage, at the time of my visit.

(15.) MACFARLANE MINE

Is on the north side of the Kanawha river, nearly opposite the shipping point of the Winifrede Company; the coal is lowered in the mine cars over an inclined plane, to the level land, at the foot of the hill, and hauled across the same on a tramway, about a quarter of a mile long, to the river tipple, and there transferred to barges and shipped west by river.

This is a new mine, having been opened in 1883, and at the time of my inspection, was not in good condition. The mine was attempted to be ventilated by a shaft, with a fire at the bottom of it, but as the shaft was wet, and the wind often came over the spur of the mountain and blew down the shaft, this plan of ventilation has not proved successful. I suggested to the superintendent the erection a fan, such as I saw at work at the Moundsville shaft, which has been done. Besides poor ventilation, I found the roads in this mine quite sloppy.

(16) REYNOLDS & STURDEVANT.

This firm opened a mine on Cabin creek on the line of the Kanawha railway and upon the lands of the Cabin Creek-Kanawha Coal Co., in the latter part of 1882, but so far have done very little work, and as the number of miners employed was considerably under fifteen, I did not inspect this mine. The Kanawha railway is a standard gauge road and was built during the years 1881 and 1882, from a point on the Kanawha river about a quarter of a mile above the mouth of Cabin creek, up this creek for a distance of five and one-half miles to the mouth of the Long Bottom Branch and thence up this branch three and one-half miles into the heart of the lands of the Cabin Creek-Kanawha Coal Co., and of the Williams Coal Co.; the whole length of the road being nine miles. At the Kanawha river terminus of this railroad there is a river tipple by which the six ton, centre-dump cars of the road are lowered and the coal dumped from them directly into the barges. This road also connects with the Cheapeake and Ohio railway.

(17.) STEVENS COAL AND COKE CO.'S MINE

Is also on the line of the Kanawha railway, and having been opened in 1883, there has been very little work done; and as only a few miners were employed, it was not inspected.

(18.) McCARTY BROTHERS

Opened a mine on the Kanawha railway but a short distance above the Stevens Coal and Coke Co.'s mine, in 1883, and like the last named company have done very little. Mine not inspected.

(19 and 20.) COALBURGH MINES

Are opened in the river mountain at Coalburgh and have been in operation for about twenty-four years. The coal is lowered in the mine cars over an inclined plane to the railroad tipple where it is transferred to railroad cars, if shipments are made by rail, or to another car and then run down a second inclined plane (which is short) to the river tipple and there transferred to barges, if shipments are made by river. The entrance to the lower or western mine is at the head of the inclined plane; the mouth of the upper or "Blackberry" mine is two thousand eight hundred and fifty feet further east, from which the coal is hauled to the head of the plane in the mine cars, on a tramway. Both mines were dependent upon natural ventilation at the time of my inspection, and I did not find the quantity of air to be sufficient. The "Blackberry" mine roads were sloppy in places but the drainage of the lower mine was good. I suggested by letter of October 2, 1883, that a ventilating furnace be built at each mine, but nothing has been done in that direction so far.

The following analyses of the coal were furnished me by Neil Robinson, Esq., the manager:

Analysis April 11, 1883, by Henry Frechling, Richmond.

Fixed Carbon	58.322
Volatile Matter	37.100
Ash	3.568

The above analysis was from samples from lower part of seam.

Analysis by Dr. G. M. Levette, Indiana State Geological Survey.

Fixed Carbon	62.00
Gas	32.50
Water	4.00
White Ash	1.50
	100.00

Average of three analyses from top, middle and bottom of seam.

Test of twenty-one thousand pounds of the Coalburg coal, by the South Boston Gas Company, Boston, Massachusetts; yield, ten thousand seven hundred and seven cubic feet of gas per ton of coal, or 4 78–100 cubic feet of gas per pound of coal, with an average candle power of 17 8–10. When yield was reduced to nine thousand nine hundred cubic feet of gas per ton of coal, the candle power averaged twenty.

(21.) CONNELL MINE,

Operated by the Peabody Coal Company, is opened in the mountain fronting the river, and the coal is lowered in the mine cars over an inclined plane, to the river tipple, where it is transferred to barges and shipped west by river. This mine was opened in May, 1882, and has been laid out and worked with commendable regularity; the system of working in vogue here being the same as that introduced at Coalburgh by Mr. Robert Brabbin, Sr., the mine boss at the last named mine. All rooms and entries are driven by centres set by the compass, and the consequence is, that the thickness of pillars is not an hypothesis, as is the case at most of the mines where the face of the coal is depended on as a guide for the direction of the rooms, and very often for that of the entries. This method of driving all rooms and entries by centres is the *only* way in which a mine *can* be worked with *any* degree of *certainty* as to the size of pillars that are being left to support the superincumbent strata; *no* man's eye is equal to a surveying instrument in laying off angles *above* ground, and is still *less* accurate in the murky chambers of a coal mine. Moreover, the faces or face slips of the coal cannot be relied upon as a guide for the direction in which rooms or entries are to be driven, as these faces of the coal are very changeable, and especially so in the neighborhood of a fault or horseback. This mine is ventilated by a furnace, and at the time of my visit, the mine was in *perfect* condition as to ventilation, drainage and safety, and I hope it may always be so found.

(22.) EAST BANK MINE,

Operated by Stuart M. Buck, is situated on the head of Harriman's branch, and the coal is conveyed in the mine cars over a tramway, about one-half a mile long, to the head of the inclined plane, which

is seven hundred and twenty-five feet long, and on which the steepest grade is thirty-five degrees; the mine cars are lowered on this plane to the railroad tipple where the coal is transferred to railroad cars, if shipments are to be made by rail; but if shipments are to be made by river, the coal is here transferred to another car and in it transported over a tramway to the C. & O. railway where it is lowered on a short inclined plane to another tramway below the railroad and on the latter tramway hauled to the river tipple and there transferred to barges. On the tramway leading from the mine to the head of the main incline there is a descending grade of eight inches per hundred feet; as the loaded cars go down grade and the empties up, this adjustment of the grade line enables one mule to haul six to eight cars in either direction, though the pull is a little harder up grade with the empties than in coming down with the loaded cars. The style of car used is the ordinary "Pittsburgh" one-ton mine car with loose wheels. This mine is ventilated by a furnace and by air-compressors, which latter are used in connection with two Harrison coal cutters that are being worked in this mine. The ventilation is not as good as it should be. The mine is drained by a syphon. The general condition of the mine was fair at the time of my inspection.

(23) CEDAR GROVE MINE,

Operated by the Cedar Grove Mining Company, is situated on the north side of the Kanawha river opposite the village of Hampton. The coal is lowered in the mine cars on a short inclined plane to the river tipple where it is transferred to barges and shipped west by river. As the mine is now worked, it is practically two separate mines, one to the west of the old workings, the other to the east of them. In the western part of the mine there is an entry through the mountain, and this part of the mine is dependent upon natural ventilation, which was fair. The upper part of the mine has a ventilating furnace and the ventilation is fair. Drainage good in both portions of the mine. Letter of instruction mailed to the superintendent.

(24) KELLY'S CREEK MINE,

Operated by the Cedar Grove Pure Coal Company, was opened about the close of the year 1883, in the Cedar Grove seam at a point on the north side of the Kanawha river just a short distance north of where the James River and Kanawha turnpike crosses Kelly's creek. Ventilation is fair and drainage good. A small furnace is used for ventilating purposes. Coal is shipped west by river.

(25) BLACKSBURG MINE,

Opened in the Cedar Grove seam upon the lands of the Chesapeake and Ohio Railway Company, is operated by William Sharpe. The coal is lowered in the mine cars over a short inclined plane to the railroad tipple and transferred to the cars of the Chesapeake and Ohio

railway and shipped east. Ventilation is here maintained by a small furnace, but is insufficient. The condition of the mine as to drainage was fair.

(26) CROWN HILL MINE NO. 1,

Operated by the Crown Hill Splint Coal Company, is situated on the head of Meeting-house branch, and was opened in the year 1883. At this date, June 30, 1884, the mine is not being worked, having been abandoned about the close of the year 1883. When I inspected this mine I found it in a very bad condition in every respect. It was dependent upon natural ventilation for its air-current, and consequently there was not a sufficiency, the deficiency being largely in the majority. The roads were sloppy, and the roof was broken and falling, in nearly every part of the mine, as a natural consequence of very wide rooms and thin pillars. I ordered a ventilating furnace built and certain openings, between rooms and entries, closed with doors and stoppings. The doors were put in but nothing done towards building the furnace, except driving a drift, in which the furnace was to be built, and commencing the sinking of a shaft; but when the mine was abandoned, the ventilation had not been materially improved.

(27.) CROWN HILL NEW MINE OR NO. 2.

This is opened in the first seam under the flint ledge, and is, consequently, the same coal seam as that worked at Cannelton, where the lower part is cannel. This seam of coal was first operated at Cannelton by Aaron Stockton, and is denominated the "Stockton Seam," by Professor D. T. Ansted, the English geologist, who examined the Kanawha coal field a few years previous to the "late unpleasantness." This mine I have not inspected, but I am creditably informed that there is a ventilating furnace in operation here and that the ventilation and drainage are very fair. The new mine was opened in 1883, and has been pushed to a fair output of coal.

(28.) KANAWHA CANNEL COAL COMPANY

Are operating a mine on Paint creek five miles from the Kanawha river, in the Coalburgh seam, which at this point contains a band of cannel coal (in the lower part of the seam) ranging from three to five feet in thickness. This mine is at the upper or southern end of the Paint creek railroad of three feet gauge, built during the years 1881 and 1882. At the river terminus of the road there is a river tipple built upon the same principle, and by which, the coal is transferred to barges in the same way as at those of the Winifrede railroad and of the Kanawha railway.

The Kanawha Cannel Coal Company's mine was not found in a very praise-worthy condition at the time I inspected it, but I had the assurance of the superintendent that a ventilating furnace was to be built very soon; this however was not done until in May, 1884, when I heard that the miners were complaining very much about

the bad state of the ventilation, and I ordered a furnace built at once. My instructions were obeyed and I am informed that the air in this mine is now considered fairly good.

(29 and 30.) WYOMING MANUFACTURING COMPANY

Have two mines in operation at present, the lower one having been inspected in January, 1884; was found in bad condition, both as to drainage and ventilation. I instructed the superintendent by letter of January 31st, 1884, as to necessary improvements, among other things the building of a ventilating furnace, which has not been done nor any move made in that direction so far as I know. The upper mine was not operated by this company until this year (1884), and as there were only a few men at work, the mine has not been inspected.

(31.) KANAWHA MINING COMPANY

Are operating a mine in the same coal seam as that in which the upper mine of the Wyoming Manufacturing Company is being worked, being the third seam below the flint ledge, or the first under the Coalburgh seam. This particular seam of coal was, so far as I know, first worked by Lewis Fry Donnally in the above named mine of the Wyoming Manufacturing Company, and I have *therefore* named it the "Donnally" seam; however, it may be the "Winifrede," but of this I have not been convinced. The greater part of the output of this mine is shipped west by river. This company has an inclined plane from the mouth of the mine to the C. & O. R. R., where they have a tipple so arranged that the coal may be transferred from the mine cars either into railroad cars or into barges on the river.

At the time I inspected this mine its condition as to ventilation was abominable, and the drainage was not good in some parts of the mine. I ordered a ventilating furnace built, and doors and stoppings arranged at certain points so as to get a sufficient air-current established through the workings. This was done after so long a time, and the mine now has a good reputation as to ventilation; but unless the present system of single entry working is abandoned and the double entry plan adopted, there will always be a great deal of trouble about ventilation or a great many doors to be kept up and attended.

(32.) UNION MINE

Is operated by the Union Coal Company and worked in the Coal Valley seam, a gas coal that is mined by several companies in the vicinity of Coal Valley. The coal is lowered from the mine in the mine cars on an inclined plane five hundred and forty feet long to the railroad tipple, where it is transferred to railroad cars, if shipments are made by rail, or to another car on a short inclined plane running from the railroad tipple to the river tipple. The cars used on the last named plane are centre-dump, and the river tipple is

modeled after those of the Winifrede, Kanawha, and Paint Creek railroads, though on a much smaller scale.

This mine at the time of my inspection was as badly off for ventilation as that of the Kanawha Mining Company, and in a worse fix as to drainage. I ordered a ventilating furnace built here, and certain doors and stoppings put in and break-throughs made. The last time I was in the mine the furnace was being built but I had to wade through a good deal of water to get to it.

(33.) MOUNT MORRIS MINE,

Operated by the Mount Morris Coal Company, is on the Morris Creek Branch railroad of the C. & O. Ry. The coal is lowered from the mouth of the mine in the mine cars on a short inclined plane to the tipple where it is transferred to railroad cars. This mine, at present, has no arrangement for shipping coal by river. At the time I inspected this mine the ventilation and drainage were both in poor condition. I wrote a letter of instruction to the superintendent October 23, 1883, but learning that nothing had been done towards putting my instructions into practice, I wrote the gentleman again on November 16, 1883, warning him that if my instructions were not obeyed, I should have him indicted for violation of the mining law. I have not been in the mine since.

(34.) CARVERS' MINE,

Operated by the Carver Brothers, John and Enoch Carver, is also on the Morris Creek Branch of C. & O. Ry. The coal is lowered in the mine cars on an inclined plane one hundred and seventy-five feet long to the tipple and there transferred to railroad cars. This mine has no means of loading coal into barges on the Kanawha river. The condition of the mine as to ventilation was quite fair and the drainage was perfect, at the time of my inspection; the mine being dry throughout. Ventilation is maintained here by a shaft and fire-basket, the shaft being six feet in diameter, fifty-three feet deep and a plank stack on top of sixteen feet, making a total height of sixty-nine feet. The fire-basket is three feet square, one foot ten inches deep and hung at the bottom of the shaft and near the bottom of the coal seam. I suggested that the basket be raised a few feet so as to offer less danger of igniting the coal seam, and to cause the air to pass nearer the fire in ascending the shaft, thereby increasing the temperature of the ventilating column of air and consequently increasing the quantity circulating through the mine. I found eight thousand two hundred cubic feet of air per minute ascending the shaft and at the head workings of the mine there was four thousand five hundred cubic feet passing per minute.

(35.) EXCELSIOR MINE

Is on the Morris Creek Branch line of the C. & O. Ry. and operated by M. T. Davis & Co. The coal here is lowered in the mine cars over

a short inclined plane to the tipple and there transferred to railroad cars. All shipments from this mine are made by rail. Ventilation is here maintained by a furnace and the general condition of the mine, at the time of my visit, was fair. The quantity of air passing at the head of the workings was found to be nine thousand two hundred cubic feet per minute; on the return air-way, near the furnace there was sixteen thousand cubic feet passing per minute; the quantity of air *at* the furnace was twenty thousand cubic feet per minute, but *four thousand* cubic feet of this came through, around and under a door between the furnace and the mouth of the air-way. *This* is an *example* of the *leaky doors*, so frequently found in the mines of West Virginia.

(36.) EUREKA MINE,

Operated by M. T. Davis & Co., is situated on the same short line railroad as the Excelsior, Carvers' and Mt. Morris mines. The tipple being at the mouth of the mine, which is only about thirty feet above the track of the railroad, an inclined plane is not necessary; so the coal is transferred directly to the railroad cars at the mouth of the mine. This mine was found to be dependent upon natural ventilation and, *of course*, its condition in that respect was not what it should be. Otherwise the condition of the mine was fair. I ordered a furnace built here but do not know what has been done.

(37.) STRAUGHAN'S MINE,

Operated by George Straughan, is situated on the south side of the Kanawha river and C. & O. Ry., at the town of Coal Valley, and is opened in the Coal Valley seam. This mine was idle during a great part of the year 1883. A ventilating furnace is used for maintaining ventilation, which was found to be tolerably fair at the time of my inspection, though not as good as it should be. The drainage was not good, as the roads were quite muddy in places. When some airways are completed, which are now being driven, the ventilation will be greatly improved. There should be about fifteen feet added to the height of the furnace stack.

(38) COAL VALLEY MINE,

Operated by the Coal Valley Coal Company, was opened about ten years ago, and will probably be exhausted during the year 1884. Being opened in the end of the mountain in a bend of the river, and having six openings to daylight, and occupying a space less than one thousand eight hundred feet square, and the remaining work being almost entirely pillars to be drawn, the ventilation was found to be fair, although no artificial means were employed to produce it. I did not compel this company to build a furnace, for the reasons given above. The drainage was also found to be in good condition. The pillars in the western half of the mine have been overrun by a "squeeze" and cannot be gotten; this being the *unfailing* result of

leaving pillars *too* small for the width of rooms. This mine has no means of transferring coal to barges, so as to make shipments by river.

(39.) CANNEL MINE,

Of the Cannelton Coal Company, situated on the north side of the Kanawha river, directly opposite the town of Coal Valley, is a drift mine, entering the mountain on the east side of Staten's run, about three-quarters of mile from the river. The coal from this mine is conveyed in the mine cars over a tramway, half a mile long, to the head of the inclined plane, on which the cars are lowered on to a flat at the river. From this flat the cars are pushed on to another boat and ferried across the river, where they are transferred to another flat, from which they are hauled up an inclined plane, by means of a winding engine, into the reservoir-house, where they are dumped into a large bin or reservoir, from which the coal is loaded into C. & O. Ry. cars. This mine is dependent upon natural ventilation, which, owing to the many openings to daylight, was found to be tolerably fair, at the time of my inspection. The drainage was not good. A mine locomotive is used on the tramway.

(40) BLOCK MINE,

Of the Cannelton Coal Company, is situated directly over the Cannel mine at an elevation of about 110 feet above the cannel seam. Ventilation was found to be fair; drainage not good.

(41) CRESCENT MINES,

Capt. Wm. R. Johnson, operator, are on the C. & O. Ry. and Kanawha river, and have tipples arranged for both railroad and river shipments of coal. The upper mine, which is in the Coal Valley seam, has two inclined planes and two railroad tipples and at the foot of one of these planes is a large river tipple to be used for loading coal into barges. This upper mine, at the time of my visit, was dependent upon natural ventilation and the supply of air was not sufficient. The mine was in bad condition as to drainage in some parts; mainly that portion toward the dip of the coal seam. By letter of January 16, 1884, I ordered a ventilating furnace built, and such other improvements made as were needed to get the mine in proper condition. The furnace has been built. The lower mine is opened in the Eagle seam, but has not yet been operated to any extent and was not being worked at the time of my visit.

(42 and 43) FAULKNER'S MINES

Are operated by Frederick Faulkner, and are situated on the C. & O. Ry. and Kahawha river. The No. 1 mine is in the Eagle seam and the No. 2 mine is in the Coal Valley seam. The coal from each mine is lowered in the mine cars on separate inclined planes to a

very large combined railroad and river tipple, which has four dumping or loading chutes, two for railroad and two for river shipments. This tipple is about 300 feet long, and the floor of it is 75 feet above the river. The No. 1 mine is a new one and only a few men have been employed in it yet. No. 2 was opened in February, 1877, and is now quite extensive. The ventilation of this mine was not found to be good, as there were no artificial means employed to create an air-current; the drainage was generally fair, though a few places in the mine were found to be sloppy. I ordered a furnace built and such other arrangements made as were needed to get the mine in good condition. The furnace has been built.

(44.) EAGLE MINE

Is operated by William Wyant, and is situated on the C. & O. Ry. and Kanawha river. The coal from this mine is a coking coal, and a little more than one-fifth of the total output for 1883 was coked in the ovens near the mines. The coal that is to be shipped is lowered in the mine cars on an inclined plane to the railroad tipple and there transferred to railroad cars; the coal used in the coke ovens is run through an iron chute or tube from the mouth of the mine to the ovens. At the time I inspected this mine the ventilation was produced by a furnace; but, owing to the leakage of the doors and stoppings, the amount of air in circulation at the head of the workings was not sufficient. I found twenty thousand cubic feet of air per minute entering the furnace, while at the head of the main entry, about three thousand feet distant, there was only four thousand eight hundred cubic feet passing per minute. Besides the above named defects, the entries were forced *entirely too* far ahead of the air-current. This mine is worked on the single entry plan, with the exception of the main entry, which has an air-way alongside it. This may be a cheap plan of mining *without* a mining law, but *having* the latter it is questionable whether indictments will not cost *more* than air-ways. The drainage of the mine was not good. By letter of January 30th, 1884, I instructed the superintendent as to necessary improvements to be made for getting the mine in proper condition.

(45.) ST. CLAIR MINE,

Operated by the St. Clair Company, is situated on the C. & O. Ry. and Kanawha river. All the coal from this mine is made into coke in the ovens near the mines, the coal being run from the mine through a large iron tube into a bin above the coke ovens and drawn from the bin into a "larry" car, by which the ovens are charged.

At the time of my inspection this mine was ventilated by a furnace, but the condition of the mine was not good either as to ventilation or drainage. The system of working here is double entry, but there are no doors arranged for forcing the air up to the heads of the rooms, and no break-throughs (except by accident here and

there) between the rooms to admit of the air-current sweeping around near the working faces. These defects I ordered remedied by letter of January 30th, 1884.

(46 and 47.) GREAT KANAWHA COLLIERY COMPANY

Have opened two mines on the east side of Armstrong creek about one mile south of the Kanawha river. The No. 1 mine is in the Eagle seam, the No. 2 in the Coal Valley seam. The coal is conveyed from these mines by tramways to the head of the inclined plane, in the mine cars, and then lowered on the plane to a tipple at the foot of the mountain, where it is transferred to railroad cars, if shipments are to be made by rail, or to another car in which it is lowered on another inclined plane to the river tipple and there transferred to barges, if coal is shipped by river. The tramway from the head of the plane to the upper or No. 2 mine is three thousand six hundred feet long and has a descending grade from the mine towards the plane of about four feet per hundred feet; the tramway from the head of the plane to the other mine is nearly level and about the same length as the one to No. 2 mine. A light locomotive is used for hauling the cars on the tramways. Both mines were merely being opened up ready to make a coal output when I was there, but I ordered furnaces built for ventilating them.

(48) HAWK'S NEST MINE,

Operated by the Hawk's Nest Coal Company, (limited), is situated on Westlake branch of Mill creek. The coal is transported from the mines to the C. & O. Ry. in the mine cars over a 2½ feet gauge railroad 3¾ miles long. The first 1½ miles from the mine has a descending grade of 6 4-10 feet per 100 feet or 338 feet per mile; the grade on the remaining portions of the road ranges between 20 and 338 feet per mile, the average being about 4 feet per 100 feet or 211 2-10 feet per mile. The grade on this road being so steep, a powerful brake is required on each car, and a brake rubber to each wheel. At the lower end of the road the coal is transferred from the mine cars (which have a capacity of three gross tons) over a chute or tipple into railroad cars or into a bin from which it is drawn into a larry car used for charging the coke ovens. The mine cars are hauled to the mines by two locomotives, and a third locomotive is used in the mine to haul on the main entry. At the time of my visit this mine was depending upon natural ventilation, though a shaft had been put down and a ventilating furnace built, but on account of the necessary doors and stoppings not being yet in place the furnace had not been fired up. The condition of the mine was not good either as to ventilation or drainage, but the defects were altogether on the main entry, which is to the dip side of the workings, and is not traveled by the miners in going to or from their work. The system of working here is single entries, which are worked entirely too far ahead of the air-current and most of the rooms are in the same predicament. By

letter of February 9, 1884, I instructed the superintendent to get the mine in proper condition before the 1st day of March, 1884.

(49.) GAYMONT MINE,

Operated by Joseph Pirrung, is situated on New river and on the C. & O. Ry. This mine is being worked on the "long wall" system, but the area worked out is not large enough yet to fully demonstrate whether or not this plan of working will here be a success. The coal is lowered in the mine cars over an inclined plane to the tipple on the C. & O. Ry., and there transferred to the railroad cars. The total output of this mine is shipped east. Ventilation is here maintained by a furnace, and the condition of the mine at the time of my visit was fair in every respect.

(50.) SUNNYSIDE MINE,

Operated by Reed, Lucas & Co., is on the C. & O. Ry. and New river. The coal is lowered in the mine cars on an inclined plane to a tipple on the C. & O. Ry. and there transferred to railroad cars. There is a ventilating furnace at this mine, but it was not being used at the time of my inspection nor had it been for a long time; the mine was consequently dependent upon natural ventilation. The condition of the mine was poor in every respect. I instructed the superintendent by letter of February 11, 1884. No map has been received of this mine. Work has been suspended here for several months, I am informed.

(51.) ELMO MINE,

W. A. Burke & Co., operators, is situated on the C. & O. Ry. and New river. Here the coal is handled in the same manner as at Sunnyside. There was no ventilating furnace here and the state of the ventilation and drainage was very bad. A map of the mine was forwarded me June 17, 1884, accompanied by a letter from the superintendent, in which he states that he has not yet completed the ventilating furnace which was to have been built within two months from the time of my inspection (February 8, 1884). There is not much being done at this mine just now, which is the case generally, owing to the dullness of the coal trade.

(52.) FAYETTE MINE

Is operated by Wm. Masters & Son, and is on the line of the C. & O. Ry. and on New river. This mine was being worked on the single entry system, and there was no ventilating furnace or other artificial means of producing an air-current at the time of my inspection. The ventilation was not good, and the drainage was tolerable. Letter of instruction written the superintendent February 18, 1884. The coal is transferred at the head of the plane from the mine cars to a bin, from which it is drawn into a car which is run on the plane

only, and called a "monitor;" at the foot of the plane the coal is discharged from the "monitor" over a tipple or chute into railroad cars.

(53) NUTTALLBURG MINE,

Operated by the Nuttallburg Coal and Coke Company, is situated on the C. & O. Ry. on New river. This is quite an extensive mine, the main entry being 4,500 feet long. The plan of mining here is the single entry system, and the state of the ventilation was not good at the time of my visit; there being only 4,000 cubic feet of air per minute at the furnace, while at the head of the main entry the current was so sluggish that it would not turn the fan of the anemometer, and therefore I could not measure the quantity of air passing that point, but am sure it could not have exceeded 500 cubic feet per minute, and I am inclined to think it was less than that amount. The drainage was tolerable. The coal from this mine is lowered on an inclined plane to the C. & O. Ry. and to the coke ovens. I instructed this company by letter of February 18, 1884, as to the necessary improvements; I am of the opinion that I shall find this mine in good shape on my next visit.

(54.) KEENEY'S CREEK MINE

Is also operated by the Nuttallburg Coal and Coke Company and is on the C. & O. Ry. on New river. This is a new mine and is as yet not very extensive and has no ventilating furnace. Ventilation was not found good, drainage tolerable. The coal is transferred at the head of the plane from the mine cars to a bin from which it is drawn into the "monitor" and lowered on the plane (one thousand three hundred and fifty feet long) to the tipple at C. & O. Ry. where it is transferred to railroad cars and all shipped east. Letter of instruction mailed February 18, 1884.

(55.) CAPERTON COLLIERY.

This mine is situated on C. & O. Ry. on New river and is operated by Wm. Beury, Cooper & Co. I here found the ventilation fair, although there was no furnace; and the drainage was good. I mailed letter of instruction to this firm February 18, 1884. The coal is handled in the same manner here as at Keeney's creek. The inclined plane is one thousand four hundred and sixty feet long, measured on the slope. The "monitor" used here is of a different shape from that used at most of the New river mines, being a large plate or boiler-iron cylinder about ten feet long and four feet in diameter mounted on four wheels.

(56.) NEW RIVER MINE,

Operated by the New River Coke Company, is situated on the C. & O. Ry. on New river; the coal is lowered from the mine in a monitor

to a large bin or reservoir, at the foot of the plane, from which it is drawn into the railroad cars. The plane is one thousand two hundred feet long and has an uniform grade of thirty degrees. This company refused to give their coal output after I had *assured* them it would be treated *strictly confidential*, and would not be made public but be used for the sole purpose of arriving at the coal production of the State. I *now* wonder that I was *allowed* to enter the mine to inspect it. At the time of my inspection the number of miners given me as working in the mine was one hundred, for whom the total air-current measured at the furnace was found to be *only* six thousand cubic feet per minute; at the head of the main entry there was one thousand two hundred cubic feet of air passing per minute, and at the head of Nos. 2 and 3 entries the volume of air passing per minute amounted to one thousand nine hundred cubic feet. The drainage of this mine was good. Mailed letter of instruction February 19, 1884.

(57 and 58.) SEWELL MINES,

Of the Longdale Coal and Iron Company, are located on the C. & O. Ry. and on New river. The lower mine was not inspected as there were only four miners working in it, driving entries, and Mr. John A. McGuffin, the superintendent, informed me that he did not expect to have as many as fifteen miners in this mine for nearly two years yet, during which time he proposes to keep a small force at work driving entries, so as to have the mine sufficiently opened up to put in a large force of miners whenever the upper mine is worked out and abandoned. The upper mine is a model of regularity in the way it has been laid out and worked. The ventilation here was found to be very fair, although there was no artificial means used to produce an air-current. This can be accounted for in two ways. In the first place, the difference in elevation between the intake and outlet is fully one hundred and fifty feet, and therefore the difference in temperature between the air in the mine and that outside would cause a strong draught of air through the mine from the lowest to the highest point in winter, and in the opposite direction in summer; secondly, the mine being on very high ground and under an isolated knoll, there is always a strong breeze passing the mine, which causes a circulation of air therein at such times as the temperature of the air inside and outside the mine may happen to be the same. The drainage of this mine was not good. Letter of instruction mailed to the superintendent February 19, 1884. The inclined plane from this mine to the bin at the coke ovens alongside the C. & O. railway is a very long one.

(59) FIRE CREEK MINE,

Operated by the Fire Creek Coal and Coke Company, is situated on the west side of Fire creek, a stream entering New river on the north side. The coal is conveyed from the mine in the mine cars on a tramway 4,500 feet long to the head of the inclined plane where it is transferred to a bin from which it is drawn into the "monitor"

and lowered on the inclined plane 1,280 feet long, to the reservoir at the C. & O. Ry., where it is drawn into railroad cars or into the "larry" used for charging the coke ovens. The mouth of the mine was originally at the head of the plane, but as the workings of the mine have been extended back from this point over three-quarters of a mile, the company have determined to use the tramway above mentioned, on which they propose to work a light locomotive. The ventilation at this mine when I visited it was natural, and was very poor. The drainage was tolerable. Letter of instruction mailed to this firm February 23, 1884.

ANALYSIS.

FIRE CREEK COAL.

Water	.735
Volatile matter	22.425
Fixed carbon	75.499
Sulphur	.536
Ash	.805
	100.000

Coke per cent., 76.84.

FIRE CREEK COKE.

Water	.105
Volatile matter	.492
Fixed carbon	91.940
Sulphur	.538
Ash	6.928
	100.000

Phosphorus, .008 per cent.

The above analysis represents a coal of remarkable purity. I was a little surprised at the low Ash in the Coal, but duplicate tests were made with great care.

ANDREW S. MCCREATH.

FIRE CREEK RED ASH BITUMINOUS COAL.

Moisture	.610
Volatile Matter	22.345
Fixed carbon	75.02
Ash	1.46
Sulphur	.560
	100.000

Specific gravity	1.272
Weight per cubic foot	79.5
Parts of lead reduced 1 part coal	31.73
Percentage heating power (carbon 100)	90.78

One part pure carbon reduces 34.56 parts pure lead.

By PROF. RICKETTS,
Of School of Mines of New York

FIRE CREEK COKE.

Moisture	.110
Volatile combus. Matter	.350
Sulphur	.618
Ash	6.680
Carbon	92.242
	100.000

By J. BLODGET BRITTON,
Iron Master's Laboratory, Philadelphia, Pa.

NOTE—The large difference in the ashes of coal and coke is because coke is made altogether from slack coal, and all the small particles of slate from the entire product of the mine goes into the slack—which is not enough to justify washing.

(60.) ECHO MINE,

Situated on the C. & O. Ry., on New river, is operated by Wm. Beury, Cooper & Co., the same firm that works the Caperton colliery. This mine has a very irregular floor, which is a succession of rolls, knolls and swamps or basins, and hence the mine can not be laid out and worked with much regularity. The thickness of the coal seam is quite as variable as the surface of its floor, ranging from three to thirteen feet. There was no furnace here at the time of my inspection, and the ventilation was not good. The drainage was tolerable Letter of instruction mailed to this company February 23, 1884. The coal is lowered in a "monitor" on an inclined plane to the C. & O. Ry.

(61.) STONE CLIFF MINE NO. 1,

Operated by the Fayette Coal and Coke Company, is situated on the C. & O. Ry. on New river. The coal is hauled in the mine cars

from the mouth of the mine, to the head of the plane, on a short tramway, and there emptied into a bin, from which it is drawn into a "monitor" and lowered on the inclined plane to the reservoir at the C. & O. Ry., from which it is drawn into railroad cars or into the "larry," used for charging the coke ovens. The ventilation of this mine was found to be fair, at the time I inspected it, although no artificial means are used to produce an air-current. The drainage was good. Instructed superintendent by letter of February 23, 1884.

(62.) STONE CLIFF MINE NO. 2

Is operated by the same company as that working the No. 1 mine; is situated in another coal seam about three hundred feet above that in which the No. 1 mine is being driven, and is reached by a tramway four thousand three hundred feet long from the head of the inclined plane. The average grade on this tramway, which is descending from the mine to the head of the plane, is about 6 6-10 feet per one hundred feet, the steepest grade being about seven feet per one hundred feet. No artificial means are used for producing and air-current at this mine; the ventilation, however, was found to be fair and the drainage tolerable. Instructed superintendent by letter of February 23, 1884.

(63.) QUNNIMONT MINE,

Operated by the Qunnimont Coal and Iron Company, is situated on Laurel creek, a northeren tributary of New river. This mine covers a space about four thousand by two thousand feet, in which six and three-quarter miles of entries have been driven, as shown by the map furnished me by the company. This mine, like the Echo mine, is full of rolls and swamps, and that is the reason assigned for such a tremendous amount of entry work; the entries having been driven to follow the swamps, and the rooms having been worked up hill on the rolls. The same amount of entry work, if driven in entries parallel to one another, three hundred and fifty feet apart, and in straight lines, would have opened up an area of six thousand by two thousand feet, instead of four thousand by two thousand feet; but whether the entries could have been *so* driven in *this* mine, at a *profit*, I am not able to say. The ventilation here, at the time of my visit, was fair, although no artificial means were employed for producing an air-current; the drainage was not good. I wrote a letter of instruction to the superintendent February 23, 1884.

NORTHERN DISTRICT.

(1.) ARMSTRONG MINE,

Operated by the Big Vein Coal Company, is on the West Virginia Central and Pittsburgh railroad, on the north branch of the Potomac river and about nine miles from Piedmont. This mine is operated in what is here termed the "Big Vein" of the George's creek, Maryland coal region, and here has a total thickness of from twelve to seventeen feet, with a slate parting of about two inches thickness, at two feet eight inches from the bottom of the seam. The situation of this mine is similar to that of the Longdale Iron Company's upper mine, at Sewell, on the C. & O. Ry. The Armstrong mine has an area of about one thousand eight hundred feet by one thousand feet, and has eight openings to daylight (as shown by map furnished me); hence the ventilation, though natural, was found to be fair. The drainage was good. The coal is conveyed from the mine to the West Virginia Central and Pittsburgh railway in the mine cars, which are first lowered about one hundred and seventy-five feet on an inclined plane two thousand and eighty-four feet long, on which six cars are run per trip; then they are hauled one thousand feet on a tramway, having a fall of about fifteen feet, to the head of another inclined plane one thousand eight hundred and eighty-four feet long, on which two cars are lowered per trip, about six hundred feet, to the railroad tipple, where the coal is dumped into railroad cars. The system of working here is single entry, the cross-entries being about four hundred and fifty feet apart. The rooms are driven about sixteen feet wide and four hundred feet long, and the pillars left between them are from twenty to thirty feet thick, which are drawn with very little loss or waste of coal. The rooms being four hundred feet long and the cross-entries being four hundred and fifty feet apart, there is a solid pillar or barrier of coal, fifty feet thick, left on the rear or dip side of the cross-entries, which is cut through by every fourth to sixth room, for air. Although there are no breakthroughs between the rooms, yet the heads of the rooms have good air, because there is no powder used in the mine, and the great height from the floor to the roof (twelve to seventeen feet) admits of an inward and outward air-current in such room; the cool air passing along the floor to head of the room, where the miners are at work, is heated to a certain degree by the bodies and lights of the men, and then rises and flows outward, along the roof, to the entry, where a good air-current is passing. This I proved, to my own satisfaction, by setting my lamp upon the track, a short dis-

tance inside a room, and found the blaze (as I supposed it would do) inclined toward the head of the room. Letter of instruction mailed to the superintendent March 18, 1884.

(2.) ELK GARDEN MINE NO. 1.

Owned and operated by the West Virginia Central and Pittsburgh Railway Company, is situated on a branch of the above named railway, and on the north Branch of the Potomac river, about fourteen miles from Piedmont. This mine is operated in the "big vein," here averaging twelve feet in thickness, having a band of slate two inches thick at two feet eight inches from the bottom. The situation of this mine is like that of the Armstrong and Sewell mines, being about one thousand feet above the North branch of the Potomac at Shaw station of the W. Va. C. & P. Ry. The coal is conveyed from the mine in the mine cars on a tramway about three-quarters of a mile long to the head of the inclined plane, down which they are lowered to the tipple where the coal is dumped into railroad cars. A similar system of working to that in vogue at the Armstrong mine is followed here, but this mine is much more extensive and has a field of coal to work out of about two hundred and seventy-five acres as shown by the map furnished me. A light locomotive is used on the tramway leading from the mine to the head of the plane. I found the ventilation of this mine fair, although it was natural, but by letter of March 18, 1884, I advised the building of ventilating furnaces, one for each portion of the mine, which is about equally divided by the main entry, and each part of the mine has an air-shaft. At the time of my inspection the main entry was the intake, the air passing to the head of it where it was split, one part going to ventilate the right hand portion of the mine, the other part ventilating the workings to the left of the main entry. The drainage was fair. This company are, I am sure, disposed to do all in their power to keep their mine in perfect order in every respect, and have in charge of this mine one of the most competent mine bosses in the State.

(3.) ELK GARDEN MINE NO. 2

Is owned and operated by the W. Va. C. & P. Ry. Co., and is about a mile distant from the No. 1 mine and operated in the same seam of coal. The plan of working is somewhat similar to that practiced at the No. 1 mine. The ventilation here was natural at the time of my visit and found to be fair but not so good as in No. 1; the drainage was also reasonably good. Letter of instruction mailed March 18, 1884, in which I suggested the erection of a ventilating furnace for this mine also. The coal is lowered from the mouth of the mine in the mine cars on an inclined plane to the branch line of the W. Va. C. & P. Ry., mentioned in the description of the No. 1 mine, where it is transferred to railroad cars.

(4.) AUSTEN MINE,

Operated by Colgate & Company of New York City, is situated on the Baltimore and Ohio railroad about three hundred yards west of Murray's tunnel. The coal seam dips to the southwest at the rate of three degrees as shown by map furnished me. The ventilation was fair, though no artificial means were employed for producing the same. The mine was well drained and the roof good. The coal is dumped into railroad cars at the mouth of the mine. There are fifty coke ovens here. I mailed letter of instruction to superintendent March 18, 1884.

(5 and 6.) NEWBURG MINES,

Operated by the Newburg-Orrel Coal Company, are situated on the Baltimore and Ohio railroad near the town of Newburg. There are four separate and distinct mines situated, like those at Elk Garden, on the top of the mountain, so to speak. The coal from these four mines is hauled in the mine cars, on a forty-two inch gauge railroad, to the head of an inclined plane two thousand feet long (the head of which is four hundred feet above the Baltimore and Ohio railroad), and lowered on this plane to the tipple and there transferred to railroad cars. The total length of narrow gauge track on top of the mountain, from the head of the plane to the various mines, amounts to six miles, and the cars are hauled to and fro by two four-wheeled, saddle-tank locomotives. The equipment of mine cars is one hundred and eighteen two-ton cars. Of the four mines above named there was only one in which more than fifteen miners were employed, and that was the only one I inspected. The ventilation was found to be fair, although it was not produced by artificial means. The drainage was tolerable. Letter of instruction mailed March 18, 1884.

Near the Baltimore and Ohio railroad track a shaft has been sunk three hundred and sixty feet deep to a seven and a half feet coal seam. At one hundred and seventy-three feet from the surface a coal seam was passed through of four feet thickness which the superintendent says is the seam worked at Austen. Nothing was being done at the shaft when I was there except pumping out the water, and as there was forty or fifty feet of it in the shaft I did not go down.

(7.) IRONDALE MINE,

Situated on Three Fork creek, about one and a quarter miles from the Baltimore and Ohio railroad at Hardman's switch, is owned by F. Nemegyei, and operated in connection with his Irondale furnace which is situated about a mile further up the creek. All the coal produced is coked and used at the iron furnace. At the time of my visit the ventilation was fair and was produced by the heat from the steam pipe leading from the boilers, at the mouth of the mine, down the slope to the pump used for draining the mine. The drainage was good. In my letter of instruction of March 18, 1884, I advised

the use of steam jets for the purpose of producing an air-current through the mine.

(8.) FLEMINGTON MINE

Is operated by the Taylor County Coal Company and is on the Parkersburg branch of the Baltimore and Ohio railroad. At the time of my visit this mine was not in operation and had not been worked for several months. The ventilation was natural but not very good, so far as I could judge from what I saw of the mine. The drainage was not good. Instructed the superintendent by letter of March 25, 1884, as to needed improvements.

(9.) TYRCONNEL MINE,

Operated by the Newburg-Orrel Coal Company, is on the Parkersburg branch of the B. & O. R. R. This mine was dependent upon natural ventilation, which, as well as drainage, was generally fair. Letter of instruction mailed superintendent March 25, 1884.

(10.) OCEAN COLLIERY,

On the Parkersburg branch of the B. & O. R. R., is operated by the Consolidated Coal and Mining Company. This mine is dependent upon natural ventilation, which was found to be very poor. The drainage was no better, the roads being in a very sloppy condition. Mailed letter of instruction to the superintendent March 25, 1884.

(11) MURPHY'S RUN MINE,

Owned and operated by the heirs of Burr Wakeman, is situated at the west end of No. 1 tunnel on the Parkersburg branch of the B. & O. R. R. The ventilation of this mine was not good; the drainage, however, was very fair. Mailed letter of instruction to the superintendent March 25, 1884.

ANALYSIS OF MURPHY'S RUN COAL, FURNISHED BY CRUGER W. SMITH, ESQ., SUPERINTENDENT.

Moisture	1.575
Volatile matter	37.105
Fixed carbon	49.080
Sulphur	2.840
Ash	9.400
	100.000

(12) DESPARD MINE,

Is on the Parkersburg branch of the B. & O. R. R., and is operated by the Despard Coal Company. Natural ventilation, which was generally fair, though not so good as it should be. The drainage was perfect, and the mine boss offers a reward of $10 to any person who will find a spoonful of water in any of the roads. There are

eighteen coke ovens here. Mailed letter of instruction to superintendent March 25, 1884.

(13.) HARRISON COUNTY MINE

Is on the Parkersburg branch of the B. & O. R. R., at Clarksburg, and is operated by the Harrison County Coal and Coke Company. There are only ten miners employed here. Six coke ovens had just been completed, when I was there, and were being charged for the first time. Mine not inspected.

(14.) PINNICKINNICK MINE

Is also situated at Clarksburg, and is operated by Jackson & Clifford. The mine was not being worked at the time I was there. Six miners is the usual number employed. Mine not inspected. The superintendent informed me, that he expected to employ fifteen or more miners inside of a year.

(15.) PATTON'S MINE,

At Clarksburg, on the Parkersburg branch of the B. & O. R. R., is operated by Luther Patton; the total output is shipped to Weston. Eight to ten miners are employed here. I did not inspect the mine.

(16.) FARLAND'S MINE,

Situated a short distance west of Clarksburg, on the Parkersburg branch of the B. & O. R. R., is operated by J. T. Farland. At the time of my visit, this mine was idle, and had been since September, 1883. I went through the mine, at the request of Mr. Farland, in company with him and his mine boss. He told me that, although he had heretofore been working only about seven miners, that he expected to have enough men employed as miners this fall, to bring his mine under the mining law. There are twenty coke ovens here.

(17.) WILSONBURG MINE,

At Wilsonburg, on the Parkersburg branch of the B. & O. R. R., is operated by the Monongahela Gas Coal Company. This mine was dependent upon natural ventilation, which was *very* poor at the time of my inspection. Drainage was found to be fair. Here there are thirty coke ovens. Mailed letter of instruction to the superintendent March 26, 1884.

(18.) WOLF'S SUMMIT MINE,

At Wolf's Summit, on the Parkersburg branch of the B. & O. R. R., is operated by Patrick Dolan. The average mining force here employed is six to eight miners. I did not inspect this mine.

(19.) VOLCANIC MINE,

Is on the Volcano branch of the B. & O. R. R., in Wood county, two miles from Volcano Junction. The coal produced is used by the oil wells in the vicinity. Michael Beane operates this mine and employs about seven miners. Mine not inspected.

(20.) O'BRIEN'S MINE

Is also on the Volcano branch of the B. & O. R. R., in Wood county, two miles from Volcano Junction, and is operated by John O'Brien. The coal from this mine is also used by the pumping engines at the oil wells. Mining force, nine miners. No inspection made.

(21.) PEW'S MINE,

On the same "short line" as the Volcanic mine and O'Brien's, is three miles from Volcano Junction, and is operated by D. C. Pew & Co. The coal is used for the same purpose as that from the two last named mines. About four miners are employed here. No inspection made.

(22.) RITCHIE MINE,

Situated on the same branch line as the three mines last named, is in Ritchie county, three and one-half miles from Volcano Junction, and is operated by Michael Beane. The coal from this mine is also used by pump engines at the oil wells in the neighborhood. The average mining force here employed is about seven men. No inspection made.

(23.) GASTON MINE,

Operated by the Gaston Gas Coal Company, is situated on the West fork of the Monongahela river one and a quarter miles from the main line of the B. & O. R. R., and is connected therewith by a branch track which joins the main track at the junction of the West Fork and Tygart's Valley rivers. The mouth of the mine is about forty feet above the level of the river, but the head workings are below that level. Fire-damp (light carburetted hydrogen gas) is evolved in this mine. On the 27th day of March, 1880, two men were killed and a driver boy badly burned by an explosion of fire-damp in the head of an entry in this mine. The entry, at the time the explosion occurred, was being driven to the rise of the seam and there being an insufficient air-current to expel the gas, it accumulated in such a quantity, in the head of the entry, that when the naked lights of the miners came in contact with it an explosion resulted, killing the two miners. The boy was sent into the same place afterwards, for something, when the gas flashed again and burned him badly though not fatally. There was a suit brought against the company for two thousand dollars damages for the injuries sustained by the boy. This suit was decided in favor of the

complainant but the company have taken an appeal and a final decision of the case has not been made, so far as I am informed. This mine is now being driven altogether to the dip and any gas given off will naturally drain out at the mouth of the mine as it is lighter than air. The ventilation at the time of my visit was natural, except that a steam pipe leading from the boiler at the mouth of the "old" main entry to the pump at the head of this entry, heats the air therein considerably, which causes a draught out through this old main entry. The ventilation was not good and I suggested that a wooden stack be built at the mouth of the old main entry and a set of steam jets similar to those employed at the Bennington mine be placed in the board stack to blow upward in it and cause a stronger draft of air through the mine. The superintendent writes me as follows, on May 20, 1884: "We have adopted your suggestion of the stack and steam-jets, and it works all right. Good current of air all through the mine and no complaint of powder smoke, etc." The drainage was generally fair but in some parts of the mine the roads were sloppy. Letter of instruction mailed to superintendent April 5, 1884.

REPORT ON THE GASTON COAL OF FAIRMONT, WEST VIRGINIA, BY S. CALVERT FORD, U. S. INSPECTOR OF GAS AND METERS, FOR THE DISTRICT OF COLUMBIA.

I have made a careful chemical analysis, and practical assay of an average sample of the Gaston mine coal, received on the 7th inst. from James O. Watson, Fairmont, West Virginia, and have obtained the following results:

ANALYSIS.

Volatile Matter	Gas, Tar, Etc.	38.17	
	Sulphur	.53	39.60
	Water at 212° F.	.90	
Coke	Fixed Carbon	51.92	
	Sulphur	.89	60.40
	Ash	4.59	
			100.

COKE, DRY, PER TON OF COAL 1352 POUNDS.

Analysis of the Coke, Dry.

Carbonaceous or combustible Matter	90.91
Sulphur	1.49
Ash	7.60
	100.

Specific Gravity of the coal	1.288
Weight of Cubic Foot in Pounds	80.50

PRACTICAL RESULTS.

Gas, per pound of Coal, at 60° Farenheit and 30 inch Bar	5.44 Cubic Feet
Gas, per ton of 2240 lbs of Coal at 60° Farenheit and 30 inch Bar	12185 Cubic Feet

Illuminating power in Standard Sperm Candles, by "Sugg Letheby" "Argand" "Old Parliamentary Burner," with seven inch chimney, consuming five cubic feet per hour, 16.51 candles. Illuminating power in Standard Sperm Candles, by Sugg's New London Argand Burner, D. 24 holes, with seven inch chimney, consuming five cubic feet per hour, 17.89

candles. Value of one cubic foot of Gas, in grains of Sperm, 396; equivalent of a ton of coal, in pounds of Sperm Candles, 689 32; durability of one cubic foot of Gas, by five inch flame, 35 minutes; Specific Gravity of Gas, Air, 1000. 510.

The Gaston mine coal of Fairmont, West Virginia, is first-class for Gas purposes, affording a very handsome yield, 12185. cubic feet to the ton, the Gas is of superior quality, five cubic feet being equal to 16 51 candles, by the old Standard Argand burner.

The same consumption, with the new London Argand burner, which is the accepted standard in England, gives a light equal to 17.89 candles.

The Coke is of fine quality, burns freely and gives a good heat, 1352. pounds produced from one ton, 2240 lbs. of coal.

S. CALVERT FORD,
Washington, D. C., March 22, 1879. *Inspector of Gas and Meters.*

(24.) PALATINE MINE,

Operated by the Newburg-Orrel Coal Company, is at the junction of West Fork and Tygarts Valley rivers, and on the B. & O. R. R. The ventilation of this mine, when I inspected it, was natural, but fair; drainage the same. Letter of instruction April 5, 1884. The coal is lowered from the mouth of the mine in the mine cars on an inclined plane to a tipple on the B. & O. R. R., and there transferred to railroad cars.

(25.) CENTRAL MINE,

Operated by Oliver Jackson, is on the B. & O. R. R. two miles north of Fairmont. This mine employs only about eight miners, and therefore does not come under the law, but was inspected at the request of Mr. Jackson, and found to be in a fair condition generally. Natural ventilation.

(26.) WEST FAIRMONT SHAFT

Is on Buffalo creek and B. & O. R. R., and is operated by the West Fairmont & Marion County Consolidated Gas Coal Company. At the time of my visit this mine was not being operated and was not inspected. Work had been suspended on the 27th of January, 1884, and the superintendent did not know when operations would be resumed. This shaft is one hundred and twenty-five feet deep, from surface to bottom of coal seam. Ventilation is produced by exhaust steam from pump into upcast part of the shaft; also have a steam jet at the surface, which is in the botton of a wooden stack fifty-five feet high, which stands on top of the upcast part of the shaft. The steam jet is seldom used. This mine produces fire-damp. Mailed letter of instruction to the superintendent April 5, 1884, in which I suggested the placing of ten or twelve steam jets at the bottom of the wooden stack.

(27.) MOUNDSVILLE SHAFT,

Situated at Moundsville, is operated by the Moundsville Coal Company. This shaft is one hundred and fifty-three feet deep from

surface to the bottom of the coal seam. At the time of my visit there were only six miners employed, and they were driving entries. This is a new mine, and has been opened but a short time. It is well ventilated and drained. Ventilation is maintained by a fan, ten feet in diameter and two feet eleven inches across the blades, which forces air down one portion of the shaft, thence to the head of the air-way and back along the main entry to the shaft and up through the hoisting way. By running this fan at a speed of sixty revolutions per minute gave a velocity of air-current at a short distance from the bottom of the downcast of five hundred and twenty feet per minute; here the area was forty square feet, hence the quantity of air passing per minute was twenty thousand eight hundred cubic feet; by running the fan at one hundred revolutions per minute the velocity was over one thousand feet per minute, hence the quantity of air passing per minute was forty thousand cubic feet. This fan in position ready to work did not cost more than $275, including the engine that runs the fan. This fan is manufactured by the Brazil Foundry and Machine Shops, Brazil, Indiana. I consider this the most *economical* and *safest* means of ventilation that can be employed in *most* of the mines of West Virginia, and hope to see fans *generally* adopted. Letter of instruction mailed superintendent. This mine produces fire damp freely.

(28.) BENWOOD IRON WORKS MINE,

On the B. & O. R. R., about two hundred yards above the Bellaire bridge, is operated by the Benwood Iron Works. This is a drift mine entering the hill on a level with the bottom lands, and is ventilated by a furnace of about five feet diameter of arch, twelve feet long; the stack is four feet square inside and thirty feet high. The ventilation was not sufficient, there being only three thousand three hundred cubic feet of air per minute entering the mine, and only one thousand seven hundred cubic feet per minute at the head workings, and this for twenty-six miners, eleven drivers, eleven mules and two tracklayers. Fire damp has been found at times in this mine. Mailed letter of instruction to the superintendent April 18th, 1884. The output of this mine is used at the iron works.

(29.) BENWOOD COAL WORKS MINE,

Situated on the B. & O. R. R., about one hundred yards north of the Benwood Iron Works' mine, is operated by W. & O. McMellan, who at the time of my visit had only five miners employed, and stated that they had never worked more than ten miners since the passage of the mining law. I did not inspect this mine. It is ventilated by a furnace and drained by a syphon. The coal produced is sold in the town of Benwood and some shipped by railroad.

(30.) AUGUST SHAD'S MINE,

Is on the B. & O. R. R., about three hundred yards north of the

Benwood Coal Works. Five miners were employed here at the time of my visit, and I was informed that the greatest number employed never exceeds seven. The total output is used by the Riverside Iron Works.

(31.) HENRY MASON'S MINE,

Is about two hundred yards up Boggs' Run from the B. & O. R. R. and is on the south side of the run. Three miners are employed, and the total output of the mine is used for domestic purposes in the neighborhood.

(32.) BOGGS' RUN MINE

Was formerly two mines, but is now one, as the mines have been connected and one air-current ventilates both. This mine is operated by the Boggs' Run Mining and Manufacturing Company and is on the B. & O. R. R. just north of Boggs' run. The ventilation is produced by a furnace, but was *very* poor in the working parts of the mine at the time of my visit; the furnace being entirely too small, and the break-throughs in the room pillars not being of sufficient size, nor in the proper places, to allow the air current (what little there was) to sweep near the working faces. The drainage was fair. Letter of instruction mailed the superintendent April 19, 1884.

(33.) MICHAEL BELL'S MINE

Is one hundred yards above the upper opening of the Boggs' Run Mine. At the time of my visit only four miners were employed, and this is about as many as ever work here. Ventilation is maintained by a furnace. The output of this mine is used for domestic purposes in the vicinity.

(34.) RITCHIETOWN MINE,

Situated on the B. & O. R. R. about two hundred and fifty yards above Bell's mine, is operated by Kasley & Brooks. Ventilation is produced by a furnace five feet eight inches wide inside, nineteen and one-half feet long, stack five feet in diameter and thirty-seven feet high; at the junction of the arch and stack there a is contraction of the furnace to four feet by twenty-two inches. *This is radically wrong.* Air, after being heated by passing over the fire, expands, and should, consequently, not be forced through a smaller area *after* it is heated, but, on the contrary, should have more space. This idea of making a contracted throat to the ventilating furnace prevails generally about Wheeling, and has probably been adopted from the plan of the heating furnaces used in the rolling mills; but the latter are built especially for the purpose of heating iron and not to pass a large volume of air. The return airway, near the furnace, (of this mine), was so choked up with rubbish that the area, through which the air had to pass, before it got to the furnace, was only six and two-thirds square feet, and the same condition was found at the

far end of the return airway where it joins the workings. The volume of air found on the return, near the furnace, was 1,420 cubic feet per minute; at the head of the return, 1,088 cubic feet per minute, and at the intake, 2,500 cubic feet per minute. The ventilation was insufficient; the drainage was fair. Instructed the superintendent by letter of April 19, 1884.

(35.) SOUTH SIDE COAL BANK

Is operated by Kasley & Brooks, and was formerly known as the Glass-house mine. Ventilation is produced by a shaft ninety feet deep, six feet in diameter, on top of which is a brick stack five feet square inside and eighteen feet high, making a total height of shaft and stack of one hundred and eight feet, at the bottom of which is a boiler used to furnish steam to the pumps which drain the mine. The boiler is thirty inches in diameter and fourteen feet long, and the furnace under it is three and one-half feet by seven feet, with a space of sixteen inches between the top of grate bars and bottom of boiler. The volume of air found entering the shaft was 5,700 cubic feet per minute. The front part of the mine is drained by a ten inch diameter sewer pipe laid seventeen feet under the coal, at the mouth of the mine, and extending one hundred and fifty yards into the mine, where it comes to the bottom of the seam; also by two steam pumps, at the shaft, which draw water from a pump near by and discharge it at the top of the shaft. One of these pumps is a No. 5 "Cooper," three inch suction pipe, two and one-half inch discharge; the other is a No. 9 "Knowles," five inch suction and four inch discharge pipe.

The ventilation of this mine was found to be insufficient, and the drainage poor. Letter of instruction mailed April 19th, 1884. There is one thing, however, to be said in palliation of the drainage; this mine virtually drains the LaBelle, as it is to the dip side of and near it.

(36.) LABELLE MINE

Is the next above or north of the South Side mine, and is operated by the LaBelle Iron Works. This mine is ventilated by a furnace four feet four inches wide, and ten feet long, grate bars five feet long, shaft forty-five feet deep lined with brick, stack four feet internal diameter, which extends ten feet above the ground surface, making total height of stack fifty-five feet from the top of the furnace arch. The ventilation of this mine was found to be insufficient; the drainage (owing to causes named in the description of the South Side Mine) was fair. Letter of instruction mailed April 21st, 1884.

(37.) LANCASTER & HERCULES

Have a small mine in the end of the hill just above Caldwell's run. There are three or four miners employed here. The latter name in the firm is indicative of great strength, but it does not necessarily follow that this is an immense concern. Mine not inspected.

(38.) RIVERSIDE MINE,

Operated by the Riverside Iron Works, is situated on the north side of Caldwell's run. Ventilation is maintained by a furnace six feet wide, fifteen feet long, seven feet grate bars; shaft ninety-four feet deep, on top of which is an old boiler shell, three and a half feet in diameter and twenty-six feet long, used for a stack. The volume of the air-current was found to be 5,600 cubic feet per minute at the intake, *720 cubic feet per minute at the head of the workings*, and 3,737 cubic feet per minute at the furnace. The ventilation in the workings was *very* poor. The drainage was *excellent*, and the timbering on the main haulway the best in the State. The cause of the deficiency in ventilation here is due to the *narrow throat* of the furnace, to the stack having too small a diameter, and to the stoppings and doors between the intake and return air-ways leaking *enormously*. Letter of instruction mailed to the general manager of this firm April 21, 1884.

(39.) BELMONT MINE,

The next above or north of the Riverside mine, and just below or south of Wheeling creek, is operated by the Belmont Nail Works. Ventilation is maintained by a ventilating furnace at the bottom of a shaft ninety feet deep, into which the flues of a boiler, used for producing steam for the drainage pumps, play. The volume of the air-current at the intake was 3,260 cubic feet per minute; at the furnace 6,550 cubic feet per minute; at the head of the workings 625 cubic feet per minute; and just back of the door on the return air-way near the furnace, 5,460 cubic feet per minute. This mine is connected with the Whittaker mine, and at the point were the connection was made there is a door which leaks a large quantity of air, and this accounts for there being more air at the furnace than there is apparently entering the mine. The difference of nearly 1,100 cubic feet of air per minute between the quantity found at the furnace and at the point on the return air-way just back of the door on the break-through leading from the main entry to the furnace, shows the leakage through that door alone. A difference of nearly 5,000 cubic feet of air per minute between the measurement taken on the return air-way and the one made at the head of the workings, shows the enormous leakage through the doors and stoppings between the intake and return air-ways. The condition of this mine as to ventilation was not good; as to drainage, fair. Letter of instruction mailed the superintendent April 23, 1884.

(40.) CRESCENT MINE

Is on the south side of Wheeling creek, and is operated by Kasley & Brooks. This mine I did not inspect, as I was informed there were only eleven miners employed in summer and thirteen in winter. Ventilation is maintained by a furnace five feet wide, two and one-half feet space above the grate bars; arch sixteen feet long; stack

four feet seven inches square and thirty-two feet high. Natural drainage.

(41.) WHITAKER MINE

Is the next above the Cresent, on the south side of the creek, and is operated by the Whitaker Iron Company. The ventilation, which is here maintained by a furnace, was found to be insufficient. The drainage is perfect, the mine being dry throughout. Letter of instruction mailed the superintendent April 23, 1884. I have, since that date, received a letter from the superintendent, in which he states, that he is going to put up a fan to ventilate the mine: and on June 27, 1884, he writes: "We have our air-way completed and are just beginning the erection of our fan, which will be completed with the least possible delay, when we hope to have abundance of good air."

(42.) MANCHESTER MINE NO 1,

Next above the Whitaker mine, on the south side of the creek, is operated by the Manchester Coal Company. Here the ventilation is maintained by a furnace three and one-half feet wide and twenty feet long; the stack is thirty feet high, from the top of the arch, and three feet inner diameter. The furnace was choked up by the fire and by a bridge wall so that there was not a sufficient area for the passage of the air. The return air-way was also filled, to a considerable extent, with fallen roof, &c. The quantity of air found entering the furnace was 1,600 cubic feet per minute, but 600 cubic feet of this leaked through a door in a break-through leading from the main entry to the furnace, hence the actual quantity of air returning to the furnace was 1,000 cubic feet per minute. At the head of the workings there was not a sufficient velocity of the air-current to turn the fan of the anemometer, hence the volume of air passing that point could not have exceeded 600 cubic feet per minute. It is plain, from the above measurements, that the ventilation of this mine was *not good*. The drainage was fair, with the exception of a few places on the main haulway, which were a little sloppy. Mailed a letter of instruction to the superintendent April 23, 1884.

(43.) WERNER'S MINE,

A short distance above the Manchester mine, and on the south side of the creek, is operated by Joseph Werner. There were only eight miners at work at the time of my visit and I was informed that the mine was nearly worked out, there being a block of coal one hundred and forty by forty yards yet to be gotten out. I made no inspection. Mailed a letter of instruction to Mr. Werner April 23, 1884.

(44.) CENTRAL GLASS-HOUSE MINE,

Just above Werner's, on the south side of the creek, is operated by the Central Glass Company. The greatest number of miners employed never exceeds eight. I did not inspect the mine.

(45.) FULTON MINE,

On the north side of Wheeling creek, at Fulton, is operated by Marshall, VanFossen & Co. The condition of this mine was *perfectly abominable* in *every* respect. The ventilation was natural. There was no sign of any *attempt* at drainage; the water, in some places on the main roads, being nearly knee-deep. The roof was poorly propped on the main haulway. Letter of instruction mailed the superintendent April 23, 1884.

(46.) MANCHESTER MINE NO. 2

Is on the Pittsburgh, Wheeling and Baltimore railroad, near Mount De Chantal. This mine is operated by the Manchester Coal Company. It is the intention of the company to connect this mine with the Manchester No. 1. There being only a few miners employed here, I did not inspect the mine.

(47.) ELM GROVE SHAFT,

On the Pittsburgh, Wheeling and Baltimore railroad, at Elm Grove, four miles from Wheeling, is operated by W. T. Chambers & Co. The mine is ventilated by a furnace, the arch of which is three feet inner diameter and eight feet long, thence to the bottom of the ventilating shaft there is a brick flue eighteen inches square inside and twenty-two feet long; the air passes through and around the furnace and flue to the shaft, which is six feet square inside and seventy-five feet deep, forty feet of it being through rock and thirty-five feet (the upper portion) through earth, and is timbered. On top of the shaft is a board stack twenty feet high, six feet square at the bottom and four feet square at the top. The hoisting shaft is situated about one hundred yards from the ventilating shaft and is seventy-two feet deep from the surface to the bottom of the coal seam. The mine is drained by a syphon pump. The ventilation was found to be *poor;* the drainage fair. Mailed letter of instruction to the superintendent April 24, 1884, in which I ordered that the furnace and flue be cleared away, that the ventilating shaft be arranged so that persons can safely travel up and down the same, and that a set of steam jets be arranged, in the board stack on top of the shaft, to produce a good ventilating air-current.

(48.) STRATTON'S MINE,

Near Triadelphia, on the Pittsburgh, Wheeling and Baltimore railroad, is operated by John Stratton. About three miners are employed here. I did not inspect the mine.

(49.) NEWMAN'S MINE,

Also near Triadelphia, is operated by Louis Newman, who employs not more than six miners. No inspection made.

(50.) TOP MILL MINE,

At the "Top Mill" at the north end of Wheeling, is operated by the Wheeling Iron and Nail Company. Ventilation is maintained by a furnace five and one-half feet wide inside, space over grate bars two and one-half feet, grate bars seven feet long, arch fourteen feet long, stack thirty-five feet high from top of arch, and two feet two inches square inside; there is another arch turned outside of the furnace with a space of three feet between it and the furnace arch at crown and eighteen inches between them at the springing line. The ventilation was found to be insufficient, for the number of men in the mine, but was much better than that of most of the Wheeling mines. The drainage was fair. Letter of instruction mailed the superintendent April 24, 1884, in which I called his attention to the fact that his furnace stack was too small in area, and that it should be *at least* four and one-half feet inner diameter or four feet square inside.

(51.) SLACKTOWN MINE,

About two miles above the Wheeling wharf, on the Ohio river, is operated by Marshall, Van Fossen and Company. This mine connects with the Fulton mine, and, at the time of my visit, the air-current passed through the Slacktown mine into the Fulton. The ventilation was natural and very poor. There is a ventilating furnace here but it was not in use when I went through the mine. The dimensions of the furnace are as follows: Arch five feet inner diameter, space above grate bars two and one-half feet, arch sixteen feet long, grate bars five feet long, bridge wall eighteen inches high, hence space above bridge wall was only one foot; stack two feet inner diameter and forty-five feet high. The drainage was tolerable, but there were some sloppy places on the main road. Mailed letter of instruction to the superintendent, April 23, 1884.

(52.) BOWMAN'S MINE,

About fourteen miles above Wheeling on the Ohio river, is worked by two or three miners and the coal is sold to steamboats. No inspection made.

(53) WELLSBURG MINE,

Just below Buffalo creek and on the Ohio river, is operated by Forbes, Carmichael & Company. A furnace is used for producing the ventilation which, however, was not good in the working places of the mine. The drainage was tolerable, but the roads were sloppy in several places. The dimensions of the furnace are as follows: Arch three and one-half feet, inner diameter, and sixteen feet long; stack twenty-five feef high and two feet square at the top. Letter of instruction mailed to this firm April 24, 1884.

(54) WELLSBURG SHAFT,

Situated a short distance above Buffalo creek, in the south end of the town of Wellsburg, and on the Pittsburgh, Wheeling and Kentucky Division of the Pittsburgh, Cincinnati and St. Louis railway, is operated by G. W. Crawford & Company. The shaft is two hundred and thirty-six feet deep from landing to the top of the coal seam, which is one hundred and seventy-five feet below the level of low water of the Ohio river at this point. At the time of my visit there were nine miners employed who were driving entries and cutting around the shaft pillar. Ventilation was maintained by the exhaust steam from the drainage pumps, but the superintendent told me that he would, after a little, build a ventilating furnace having an arch eleven feet wide inside and twenty-eight feet long, and with six feet grate bars. Board brattices were carried up close to the face of each entry, and, although the coal seam gives off fire-damp freely (which can be heard hissing from the sides of the entries), the air-current swept it away so rapidly that no indication of gas could be found by a naked light. Great care will have to be exercised in the working of this mine to avoid explosions. The superintendent is, I think, a thoroughly experienced man in the mining business, and will, no doubt, use due precaution in working the mine; but there is one point on which I fail to agree with him, and that is his preference for a furnace to a fan for the ventilation of this mine.

MASON COUNTY MINES.

(55.) NEW HAVEN OR FLINT HILL MINE,

On the Ohio river, in Mason county, about five miles above Pomeroy, Ohio, is operated by the New Haven Coal and Shipping Company. This is a slope mine, and the depth of the coal seam, under the surface of the Ohio river bottom lands, at this point is about one hundred and eight feet, or one hundred and thirteen feet to the bottom of the seam. The slope is double track and pitches at an angle of about twenty degrees. The mine cars are hauled up the slope by a winding engine, a chain being used instead of a wire rope, which is generally adopted for such purposes. Ventilation is maintained by a furnace five feet wide inside, thirty feet long, four feet space above the grate-bars, which are five feet long; the shaft is six feet in diameter and one hundred and thirteen feet deep from the surface to the bottom of the coal seam; on top of the shaft is a board stack six feet square and twenty-four feet high. The quantity of air found passing per minute was, at the intake 5,300 cubic feet; at the furnace, *after stirring the fire*, 10,000 cubic feet. The ventilation was fair, though not fully up to the standard. The drain-

age was not good; several sloppy places on the roads. Letter of instruction mailed the superintendent May 19th, 1884.

(56.) HARTFORD CITY MINE

Has two mouths or outlets from which coal is hauled, one at New Haven and one at Hartford City. The upper mouth, at New Haven, is about half a mile below the Flint Hill mine; the lower mouth, at Hartford, is about half a mile further down the river. This mine is operated by the Hartford City Salt Company, G. W. Moredock, General Agent; and the whole output of coal is used in the New Haven and Hartford City salt furnaces.

The mine was flooded by the great freshet in the Ohio river of last February, and had not been pumped out, though preparations were being made to do so, at the time of my visit. Of course, no inspection was made of this mine.

(57.) CALIFORNIA MINE,

On the Ohio river, three and three-quarter miles above Pomeroy, Ohio, is operated by Charles Juhling. The work being done, at the time of my inspection, was drawing pillars; a new mine was being opened back of this one in the second hill from the river. The mine was dependent upon natural ventilation, which was tolerably fair; the drainage was not good, the roads being quite sloppy. Letter of instruction mailed the operator May 20th, 1884.

(58.) SEHON MINE,

On the Ohio river, two and a half miles above Pomeroy, is operated by C. A. Bettinger & Co. This mine was formerly operated by John Young, the present firm having been working it since about the middle of April, 1884. The flood of last February filled this mine with water also, and in consequence thereof the roads were found to be very sloppy. The ventilation was natural but insufficient. Letter of instruction mailed the superintendent May 20, 1884.

(59.) MUSQUITO MINE,

About a quarter of a mile below the Sehon mine, and on the Ohio river, is operated by the Liverpool Salt Company. Ventilation is here produced by a furnace of which the arch was three and one-half feet inner diameter, twenty-five feet long and had a space of two and one-half feet above the grate bars; shaft is six feet in diameter and twelve feet deep, on top of which is a wooden stack five square and about eighteen feet high. I found 1,330 cubic feet of air per minute entering the furnace. The state of the ventilation was fair but it was insufficient. Drainage not good, roads sloppy. Letter of instruction mailed the superintendent May 20, 1884.

(60.) GERMAN FURNACE MINE,

Situated about two miles above Pomeroy, and on the Ohio river, is operated by the German Salt and Coal Company, the total output of the mine being used at the German Salt Furnace. As there were only twelve miners employed here and *never more* than that number, I did not inspect the mine.

(61.) HOPE FURNACE MINE

Is situated on the Ohio river directly opposite Pomeroy, and is operated by the Hope Manufacturing and Coal Company, who employ twelve miners in summer and fourteen in winter. The output of the mine is used by the Hope Salt Furnace. No inspection made of this mine.

(62.) GINTER'S MINE,

A short distance below the Hope Furnace mine, is operated by William Ginter, who employs three or four miners.

(63.) ROADS' MINE,

Near Ginter's mine, and a short distance below it, is operated by John Roads, who employs three or four miners.

(64.) STERLING MINE,

About one and three-quarter miles below Pomeroy, was idle at the time of my visit, and had been for several months, with no immediate prospect of resuming operations.

(65.) CLIFTON FURNACE MINE,

On the Ohio river, two miles below Pomeroy, is operated by the West Virginia and Ohio Mining and Manufacturing Company. Ventilation is produced by a furnace five feet wide, the side walls of which are built up to the roof of the coal seam instead of having an arch; space above grate bars four and one-half feet, grate bars six feet long, furnace forty feet long, stack four feet inner diameter and forty feet high, built of brick; ventilation fair, drainage poor, roads sloppy. Letter of instruction mailed the superintendent May 21, 1884.

(66.) CLIFTON ROLLING MILL MINE,

On the Ohio river, two and one-eighth miles below Pomeroy, and opposite Middleport, Ohio, is operated by the Standard Nail and Iron Company. The ventilation was tolerable but not good enough. Ventilated by a furnace six feet wide, space over grate bars three

feet, grate bars nine feet long, furnace thirty feet long, stack five feet square inside and about fifteen feet high from the top of the furnace. The quantity of air entering the furnace, after stirring the fire, was 6,800 cubic feet per minute. At the head break-through on the left hand cross-entry there was 2,000 cubic feet of air passing per minute. The drainage was not good; roads sloppy. Letter of instruction mailed the superintendent May 22, 1884.

(67.) CAMDEN MINE,

On the Ohio river, about five miles below Pomeroy, is operated by the Consolidated Coal and Mining Company, of Cincinnati, Ohio. The ventilation, which was found to be fair but not fully up to the standard, is produced by a furnace, arch five feet inner diameter, space over the grate bars three and one-fourth feet, grate bars six feet long, arch nine feet long; the stack consists of a shaft five feet in diameter and twenty-six feet deep, on top of which is an iron boiler shell three feet in diameter and twenty-five feet long, making the total height of stack fifty-one feet. The drainage was not good; roads sloppy. Mailed letter of instruction to the superintendent May 23, 1884. Almost the entire output of this mine is sold to steamboats on the Ohio river.

[Copy of blank mailed to coal operators.]

ANNUAL REPORT TO INSPECTOR OF MINES.

Name of mine .....
" " person or Co. operating mine.....
" and Address of Superintendent.....
" " " Mine Manager.....
" of Coal Seam worked.....
Character or kind of coal.....
Average thickness of coal.....
Remarks on thickness of seam.....
.....
.....
Average number of Miners employed in the mine during the year 1883.....
" " Mules and Horses " " " " " .....
" " Drivers employed " " " " " .....
" " Track-layers " " " " " " .....
" " Door-tenders " " " " " " .....
" Total " Persons " " " " " .....
" ..... " " " outside " " " " .....
" Total " " " outside & inside " " " .....
Number of Coke Ovens - - - - - - - - .....
Number of persons injured, non-fatally, in or about the mine during 1883.....
" " " " fatally, " " " " " " .....
Total " " " " ..... " " " " " " .....

DETAILED STATEMENT OF FATAL AND NON-FATAL INJURIES.

NAME.	DATE OF		CHARACTER AND CAUSE OF INJURY.
	Injury.	Death.	

COAL SHIPMENTS DURING 1883.

Total quantity of Coal shipped outside of the State, East, - .....
" " " " " " " West by R. R., ...
" " " " " " " by River, ...
" " " " " " " " .....
" " " " to points in the State, - - .....
" " " used about the mines, - - - - .....
Total output of Coal for the year 1883, - - - - - - .....
Quantity of Coal Coked during the year 1883, - - - - .....
" Coke made " " " " - - - - .....

Signed : ....., Prop'r, Sup't or Manager.

DEGO, KANAWHA CO., W. VA., ...1884.

Dear Sir :—Please fill out the above report as fully and accurately as you can and mail it to me by the 1st day of March, or as soon thereafter as possible.

The law does not require any such report from you, but I hope you will not, on that account, refuse or fail to comply with my request; as the above information, when fully collected, I shall embody in my report, and I have no doubt you can see that it will be interesting to all parties concerned in the Coal business.

In filling out quantities of coal please do not fail to make it plain as to whether your figures indicate bushels of 80 lbs. or 2,688 cubic inches, and whether tons are 2,240 lbs. or 2,000 lbs., and especially whether the figures indicate tons or bushels.

Yours very respectfully,

OSCAR A. VEAZEY, *Inspector of Mines.*

VENTILATION.

The following lecture on ventilation is taken from the second edition of that *practical* and *commendable* book, entitled "COLLIERY MANAGEMENT," written by Jonathan Hyslop, Civil and Mining Engineer:

In the treatment of this important subject we propose to consider:

I. THE NATURE AND PROPERTIES OF AIR.
II. WHY MEN BREATHE TO LIVE.
III. THE THEORY OF MINE VENTILATION; AND
IV. THE DIFFERENT VENTILATING POWERS.

Taking these in their order, we have:

I. THE NATURE AND PROPERTIES OF AIR.

The atmosphere in which we live, and in such an important sense, *by* which we live, is computed to be from forty to fifty miles in height, and consists of the following ingredients:

1. *Oxygen*, which is a gas remarkable for the energy with which it promotes combustion or burning, and respiration or breathing. A red-hot wire will burn brilliantly in it, and an animal will die through an excess of vital action.

2. *Nitrogen*, which is in the ratio of four volumes to one of oxygen in the air, neither supports combustion nor respiration, and animals, when placed in it, die, not from poison, but the absence of oxygen. Its principal use, in the atmosphere, seems to be that of diluent, subduing and modifying the intense activity of its fiery colleague.

3. *Carbonic Acid* is always present in the atmosphere in small, but varying quantities, the proportion ranging from three and three-fourths to six volumes in one thousand, and the mean being about five. Near the surface of the earth, the proportion is greater in summer than in winter, and during night than during day.

4. *Watery Vapour* is also contained in the air, arising partly

from combustion, but chiefly from contact with the surface of the sea. The average proportion is one and one-half in one hundred, but it varies according to temperature.

Other occasional ingredients mingle with these in common air, such as ammonia, and the gases arising from gas-works, furnaces, sewers, stagnant pools, etc., but the percentage is too small to affect the entire volume.

Next we specify the various properties of air:

(1.) *Impenetrability*, which is that property possessed by all solids and liquids, viz: That no two can occupy exactly the same place at the same time. Thus, if water be poured into an open-topped vessel, the air overflows at the same rate. If the vessel be close-topped, and from which the air cannot escape, the water must be forced in, and the air compressed into a smaller space.

(2.) *Weight.* This is found to be about thirty-one grains per one hundred cubic inches, but it is liable to constant variation, according to the degree of density which prevails, as instanced by the rise and fall of the mercury in the tube of the barometer.

(3.) *Inertia.* Air cannot be set in motion without the application of force, and, when in motion, it cannot be stopped except by force. Its inertia is exactly proportionate to its weight, and as the latter is so small, compared with its bulk, it follows, that a very small amount of force is sufficient to impart motion to a large bulk of air.

(4.) *Pressure.* Having weight, it must have pressure; and the space it occupies at any particular spot, is proportional to that pressure. Thus, while one hundred cubic inches at the level of the sea, with the barometer at thirty inches and the thermometer at sixty degrees, weighs thirty-one grains, at an altitude of two thousand feet, two hundred cubic inches would only weigh that amount. The ordinary pressure at the sea level is fourteen and one-half pounps per square inch, which is simply the weight of a column of air one inch square, and the height of the whole atmosphere. Owing to this pressure, a sheet of writing paper prevents the water running out of an inverted tumbler; a stone is lifted by the school boys' leather sucker; a syphon pipe discharges water over ground higher than its source; and water rises nearly thirty-two feet in the barrel of a common pump.

(5.) *Compressibility.* A tumbler full of air becomes only half full, though containing the same weight, when inverted and plunged thirty-four feet deep in water; and at one thousand feet it is compressed into one thirtieth of its original volume.

(6.) *Elasticity.* The air thus compressed instantly regains its original bulk when freed from the pressure on its surface, and this property is elasticity, a property common to all gases, and resulting from the tendency of every particle to repel every other to a distance. The greater the compressing force, the greater will be the elastic force generated, just as the more the bow is bent, the farther it will drive the arrow. It is the elastic force of the air compressed in the air-chamber of the fire engine, which drives the water with such great force through the hose pipe that a jet may be thrown over the highest flames of a burning building.

(7.) *Expansion.* Like all gaseous bodies, air expands by contact

with heat; and an increase of temperature always increases the volume, and lessens the weight, when the pressure is the same. Thus, a half-filled bladder of air will swell out, and a full one will burst on being heated at the fire; and thus, too, the parlour and the furnace fires alike cause a draught through and over them, by lessening the weight of the air, and enabling it to ascend through the denser air around. It is found that the rate of expansion is an equable one, and equal to one four hundred and fifty-ninth of volume for every additional degree of heat.

Such being the nature and properties of air, briefly explained, we have to consider,

II. WHY MEN BREATHE TO LIVE.

Throughout the human body, and extending to every part, is a beautiful, minute and complete system of canals or channels, for the passage of the blood. This blood, in an ordinary man, weighs about eighteen pounds; and the heart, like a great force pump, drives it through every part of the system, along those canals. The pulse at the wrist marks every stroke of that pump; numbering from sixty to seventy per minute in an adult man, rather more in a woman, and from one hundred and thirty to one hundred and forty in a new born infant. These strokes are in greater number when we are standing than sitting, when we are sitting than lying down, and are increased by *exercise and motion*. At every stroke about three ounces are propelled: and, hence, it requires about ninety-six strokes for every complete circle of the blood, which occupies about one and one-third minutes, at a pressure of about four pounds three ounces per square inch, or a total propelling power of about th[illegible]en pounds.

What, then, is this blood, which is propelled about forty-five times every hour, through every part of the body? It is the essence of the food taken previously into the stomach. In digestion the evil is separated from the good, the useless from the useful; and, being absorbed by the blood, is conveyed by it to every part of the body for its repair and sustenance. The blood *from* the heart, is sent through one system of canals called *arteries*, and is brought back by another system called *veins*. The arterial blood is of a bright red color, and the venous of a dark purple. And so important is this change from arterial to venous, that the blood which has once been subjected to it is not fit to pass again into the arteries *until* (mark this) *it has been purified by exposure to air* in the lungs.

Hence "the continual movement of the blood," says Dr. Carpenter, "is necessary for two purposes in particular:

"(1.) To convey the nutritive materials from the place where they were received and prepared, to that in which they are appropriate; and thus to afford to every organ a constant supply of the materials it requires; and

"(2.) To convey this fluid, at regular intervals, to certain organs by whose instrumentality it may be exposed to the influence of *air*, so as to regain the qualities it has lost and part with what it has taken up to its prejudice."

When human blood is put under the microscope, it is found to consist of two distinct parts—one a thin and nearly colorless fluid, and another of little yellow spots called *discs*, which have a diameter of from $\frac{1}{3500}$ to $\frac{1}{4000}$ of an inch, so that in the blood canals we have millions of tiny vessels propelled swiftly along, and each one laden with particular kinds of nutriment; but a principal part of the cargo outward bound, is said to be *oxygen*, of which we have already spoken. On the return voyage they bring back *carbonic acid*, or choke damp, set free in the tissues or parts to which the blood has gone.

But, inasmuch as the arterial cargo is a clean and healthy one, and the venous cargo a foul and poisonous one, it is manifest that, like other ships, the little blood discs must be cleansed at every home-coming or mischief will ensue. Hence, on either side of the heart are placed the *lungs*, which are simply a mass of innumerable air chambers, through which in its passage the foul blood is exposed to the air we inhale at every breath and cleansed from its impurities. These are thrown out at the mouth and nostrils, and the blood is again fitted for a new round of duty.

The *quantity of oxygen taken in* for this purpose and the *quantity of carbonic acid discharged*, bear a very regular proportion to *the amount of exertion* undergone by the individual; for we cannot move a hand or finger, we cannot walk a step, or make a motion, but it causes some waste or expenditure of the material of the body; and the faster the machinery goes, and the more work it has to perform, the faster does it wear. Therefore there is more new material required to make up for the waste; or in other words, the little discs must sail quicker, and carry more; must bring back more, and discharge faster, which can only be accomplished through a more abundant supply of air.

In a state of rest, an adult takes from fourteen to eighteen respirations or draughts of air each minute, and at each of these about twenty cubic inches are inhaled. Taking an average of exercise and repose, about three hundred and sixty cubic feet pass through the lungs in twenty-four hours, or about fifteen cubic feet an hour; and as air that has once passed through them contains about one-twenty-fourth part of carbonic acid, it follows that about fifteen cubic feet of this gas, containing nearly eight ounces of solid carbon, are thrown off in the course of twenty-four hours.

Now this carbonic acid, when diffused to any considerable extent, is most injurious to the system. The usual proportion in the atmosphere has already been stated to average five volumes in one thousand. Let this be increased to $\frac{1}{100}$, and its effects begin to be felt in headache, languor and general depression. In the case of a recent accident in England, one of the Government Inspectors stated that two per cent. of carbonic acid was most injurious, and four per cent. would speedily kill.

When the quantity of this gas reaches a certain proportion it produces suffocation and death. Why so? For the very same reason that the pit must stand when the wagons are all full. The blood laden with it cannot get emptied, and so stands still; because the air inhaled will not purify, owing to its want of oxygen; in other

words, "the flow of the blood is obstructed, and as the functions of the nervous system are directly dependent upon a *constant* supply of *arterial* blood, it follows that as this supply becomes progressively diminished in quantity, and deteriorated in quality, its actions first become irregular, producing violent convulsive movements, and at last cease altogether; the animal becoming insensible. If allowed to continue in this state, death is the consequence; but, if the carbonic acid in the lungs be replaced by pure air, the flow of the blood again commences; the several functions are gradually restored; the nervous system recovers its power of acting; and all goes on as before.

Such is a short sketch of the use of the air to the human system; demonstrating that if we do not even move we must breathe; if we take exercise, or work hard, we must have a large supply; and, consequently, to have healthy pits, and active productive labor, we must have free and abundant ventilation.

This will be still more manifest if we consider the state of matters in a pit with a full complement of men at work:—

(1.) Every man and horse requiring a supply of pure air, in the ratio of the work done, that the proportionate waste of the system may be at once made up.

(2.) Every man and horse exhaling into the surrounding air at every breath that carbonic acid, four or five per cent. of which is fatal to life.

(3.) Every man and horse throwing off watery vapor from the lungs and skin, to the extent of from sixteen to twenty ounces each man in twenty-four hours; this vapor containing decomposing organic matter, and other foul exhalations, tainting the atmosphere around.

(4.) The animal excretions from the bowels and kidneys, which have a fetid smell, and increase the impurity.

(5.) The decay of timber and such substances, which creates bad smells and vapors that are always deleterious.

(6.) The explosion all day long of gunpowder, forming a composition of carbonic acid, azote, oxide of carbon, watery vapor, carburetted hydrogen, and sulphuretted hydrogen, with its unburned smoke composed of unburned powder, sulpuret of potassium and sulphate of potash, which irritate powerfully the organs of respiration, and have a most disagreeable smell.

(7.) The combustion of lamps or candles, all of which are taking the oxygen from the air, and pouring more carbonic acid into the already vitiated atmosphere.

(8.) The high temperature that often prevails, causing violent perspiration in men and horses; besides quantities of impalpable dust continually borne along with the current.

(9.) The gases that are natural to a mine, such as sulphur from "brass lamps," (iron pyrites) and water trickling through the crevices around; always more or less of the dull, heavy carbonic acid, choke-damp, exuding from roof and floor, and old wastes; lying upon the pavement, where the men are working, and creeping stealthily into the blood, at every breath, as they sweat and toil; and, finally, the fiery carburetted hydrogen, which exists in greater or

less volume in most of our coal fields, and only requires a certain mixture of atmospheric air and a naked light, to make it the ruthless slayer of all within reach.

These, and some others that might be named, are the common causes always tending to destroy the healthy properties of the air in collieries; and, where an efficient circulation is not provided, can we wonder that the workmen's cheeks are thin and pale? or that asthma attacks the young? or that the men never grow old, but die? This is permitted, more or less, in many collieries, for economy's sake; and it is true, that bricks and trap-doors and brattice are saved, but it is at the expense of dropping continual grains of sand among the wheels of life, and they cannot move so actively. Instead of reducing friction, that great enemy to moving power, such economy not only clogs and hinders, but refuses the oil that overcomes it. Consequently the heart is dull when it might be cheery; the arm is tired when it might be strong; and the men go home with less work done, and more weariness, simply for want of an abundant supply of air.

This brings us to the question, what is the quantity of air necessary to insure sufficient ventilation in ordinary mines? and the following answers are appended, having the weight of competent authority:

(1.) Professor Phillips states that in most of the fiery mines an average of six hundred cubic feet per minute per collier is circulated, and that nearly two hundred cubic feet per minute are circulated for each acre of waste.

(2.) J. K. Blackwell, Esq., a government commissioner, states, in his report on ventilation, that from two hundred and fifty to five hundred cubic feet per minute should be circulated for each collier.

(3.) Mr. Hedley, Inspector of Mines, says: "In my practice, I have circulated from one hundred to five hundred cubic feet per minute for each collier."

(4.) Mr. T. J. Taylor, an eminent viewer, in answer to the question by a committee of the House of Lords, "What would be the least amount of current with which you would be satisfied in any of those pits under your management?" replied, "That would depend on the requirements of the mine; for example, in a mine which yields no fire-damp, with one hundred and twenty to one hundred and thirty persons employed in it, I should say that a current of 20,000 to 30,000 cubic feet per minute might be a fair quantity, if properly conveyed up to the face of the workings, and made to sweep those districts where the people are employed, but, in fiery mines, I should require very much more than the quantity named." And

(5.) Mr. Mackworth, Inspector of Mines, says: "After having examined and measured the ventilation in a great number of mines, I have found that where there was no escape of fire-damp, and little of any other mineral gas, one hundred cubic feet per minute for each man and boy was the *minimum* quantity of air essential for sanitary purposes alone."

We have thus been at some pains to indicate

(1.) What are the nature and properties of atmospheric air.

(2.) How necessary a constant supply of it is to the health and strength of the human frame.

(3.) That the supply required is in proportion to the amount of exertion put forth.

(4.) That owing to the many causes of vitiation in underground workings, an extra quantity is necessary to render them harmless; and

(5.) What that quantity should be, according to the testimony of witnesses alike eminent in theoretical and practical experience.

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III. THE THEORY OF MINE VENTILATION.

As fast as a shaft is sunk, the pressure of the surrounding atmosphere fills it with air. When it is completed, if a mine be driven in any direction, the same pressure will force air up to the face, however great the distance. If a second shaft from the same surface level be sunk on the face of the mine, it will also be filled in the same way: but the density in both shafts being equal, there will be no circulation; for the downward force in the one counteracts and balances the downward force in the other.

Seeing, therefore, that forces balance each other because they are equal, it follows that, if the equilibrium be destroyed, there will be a movement in the direction of the weaker. Thus, if the total resistance in two shafts be one thousand pounds, there will only be a movement in the air when the resistance in one is below five hundred; just as the arm of a weighing beam will only descend, or ascend, when the weights in the scales are unequal.

From this it follows, that the excess of force in one shaft above the other, will be the measure of the moving power; and the greater the excess the greater will be the circulation, other things being equal.

To secure this excess, the relative *density* of the opposing columns of air must be altered, either by compression in the downcast shaft, expansion in the upcast, or by pumping or exhausting the air from the latter.

When by any of these means the inertia of the air is overcome, the movement will continue constant, and in one direction, so long as the power remains unaltered.

The laws affecting the circulation of air through confined passages, such as the galleries of a mine, have been ascertained principally by eminent foreigners, such as Magnus, Regnault, Rudberg, Gay Lussac, D'Aubuisson, Gerard and Peclet, and are as follows:

(1.) The *volume* assumed by a given weight of air is inversely proportional to the pressure on each unit of surface under which it exists, so long as the *temperature* remains unaltered. Consequently there is half the volume with a double pressure, one-third with a treble pressure, and so on.

(2.) When the pressure is constant, the volume is uniformly increased in the ratio of $\frac{1}{273}$ for each additional degree of heat.

(3.) When air is discharged through orifices, offering no sensible frictional resistance, the result is sixty-five per cent. of the quantity

due to the velocity multiplied by the area in the case of a thin plate; ninety-three per cent. in the case of a short cylindrical tube; and ninety-five per cent. when the tube is conical, the area taken from the small end.

(4.) When air is impelled through a confined passage, the pressure or head of air column is proportional to *the square of the velocity*; so that to double the velocity there must be four times the pressure; to treble it, nine times, and so on.

(5.) The pressure required to propel air through a confined passage is proportional to *the length of the passage*, other things being equal; or, in other words, there must be double pressure for double distance.

(6.) The pressure required to propel air through a confined passage is proportional to the *perimeter*, or surface area of the passage, all other conditions being the same. Thus twice the pressure is required for a passage four feet square that would be required for another two feet square, the perimeter of the one being sixteen feet, and the other eight.

(7.) The pressure required on each unit of surface—square inch or square foot—to propel air through a confined passage, is inversely proportional to the sectional area of the passage. Thus, in the case of the four feet and two feet square passages, while the former required double the amount of pressure for its double-sized perimeter, that pressure would propel four times the quantity; or, otherwise, the same expenditure of power on the four feet square passage would propel double the quantity it would force through a two feet square passage, or an equal quantity would be propelled by half the power.

(8.) The pressure required to overcome the frictional resistance encountered by air in a confined passage varies with the nature of the passage; in other words, the smoother the rubbing surface the less resistance there will be.

The practical lessons taught by these laws are manifestly the following:

(1.) That as with the same pressure, the quantity is directly proportional to the nature and extent of the rubbing surface and the sectional area of the passage, all airways should be well cut, of large size, and free from sudden contractions.

(2.) That as, with the same power, the quantity propelled is directly proportional to the length of the passage, the circulation will be largely increased by judiciously splitting the air column, and separately ventilating different districts.

(3.) That only by attending to these points can efficient ventilation be produced at low velocities, and the waste of power prevented that ensues when the currents are propelled at a high speed.

The necessity for attending to these points, in arranging a system of ventilation for a colliery, will be even more obvious when we consider the waste of power that occurs in overcoming the various resistances met with in the best conducted mines. The sum of these resistances is called the "drag" of the mine, which at Hetton was found to be fifteen-sixteenths, at Tyne Main seven-eights and at Haswell ten-elevenths of the whole ventilating power employed. These facts are set forth in a most elaborate and valuable paper by

the late J. J. Atkinson, Esq., and published in vol. III. of the Transactions of the Northern Institute of Mining Engineers, and we earnestly direct the attention of advanced students to it as an exposition of the whole theory of mine ventilation. The author gives the following rules for calculating the "drag" in any colliery:

Let T=the average temperature of the upcast shaft.
t=the average temperature of the downcast shaft.
A=the sectional area of the upcast in square feet.
D=the depth of the upcast in lineal feet.
Q=the quantity of air passing in cubic feet per minute. Then the entire head of cool air column of the density due to the temperature of the downcast shaft employed in the production of ventilation, or in other words, the *nominal* power is

$$H = D \times \left\{ \frac{T - t}{459 + T} \right\}$$

And the *effective* power is

$$h = \frac{Q^2(459 + T)}{231,600\ A^2(459 + t)}$$

Hence the *drag* is

$$H - h$$

We have now to consider:

IV. VENTILATING POWERS.

It has been already shown that, in order to promote circulation through the galleries of a mine, we have but to secure that the specific gravities of the columns of air in the two shafts are different.

This result is brought about by both natural and artificial means; and hence we have natural ventilation and artificial ventilation.

In order to understand the theory of *natural ventilation*, it is necessary to remember that the heighth of the atmosphere does not follow the undulations of the surface of the earth, but that its circumference, or outer edge, is everywhere equidistant, or nearly equidistant, from the centre of the earth; so that if it be fifty miles high from the bottom of a valley, it is only forty-seven from the summit of a neighboring mountain three miles high; from which it follows, that the pressure at the latter point is always less than it is at the former.

Hence, when two shafts are sunk from the same surface level, and connected by a horizontal mine, the equilibrium of the opposing columns of air is still preserved; because, although there is a difference between the density of the outer air and that within the shafts, it is the same in both and the two counterbalance each other.

But equally it follows, that if the shafts are sunk from different surface levels to the same mineral level, and similarly connected, there will be a movement, because the mean density of the two columns will differ. Thus, suppose that the shaft temperature is *higher* than that of the outer air, and that one pit is two hundred

fathoms, and the other one hundred fathoms deep; the force in the former is made up of two hundred fathoms of light air, and the other of one hundred fathoms of light air, and one hundred fathoms of heavier air: and, therefore, the deep shaft will be the upcast. Or to put the matter differently, let one hundred fathoms of outer air weigh four hundred, and one hundred fathoms of shaft air three hundred, the opposing forces will stand thus:

Shallow Shaft—100 fathoms shaft air	300
100 fathoms outer air above it	400
	700
Deep Shaft—200 fathoms shaft air	600
Balance in favor the shallow shaft	100

which would not only force the current in the direction of the deep pit, but would be the measure of the ventilating power.

In *winter* the shaft air is warmer, and therefore specifically *lighter* than the outer air, which causes the deeper shaft to become the upcast; but in summer the case is reversed, and it becomes the downcast. At other seasons, when the temperatures are equal, or varying, the current reverses or becomes stagnant.

In reference to *the temperature of shafts* it is found that at about thirty feet below the surface it remains constant, and at the average of the annual surface temperature, increased by about one degree; and further, that from this point it increases at the rate of a degree for each fifty to seventy feet of additional depth. This being so, the natural mean temperature of a deep shaft will always be higher than that of a shallow one to the rise, which will affect the current towards the latter *adversely* in summer, and *favorably* in winter; but in any case it will render still more uncertain the movements of natural ventilation.

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We must, therefore, have recourse to some means of *artificial ventilation*, and of these we notice:

I. *The Ventilating Furnace.* The object of having a ventilating furnace is to strengthen and guide the natural current, which it does by imparting additional heat to the upcast column, and so lessening its density and specific gravity. When any volume, by contact with the fire, is thus lightened, it is no longer able to resist the pressure of the volume behind, and is pushed forward into the upcast shaft; so that no sooner does any portion of the current come over the fire than it is pushed beyond it; and the more quickly and the higher the temperature is raised, the greater will be the velocity of the stream, and the larger the quantity of air put in circulation.

The power of the furnace, therefore, mainly depends on the amount of heat communicated to the current, and the area provided for the exit of the heated air; for it is obvious, that however highly heated, there will be little circulation, if the column cannot escape freely, and also, that however large the outlet, the current will be uncertain and weak, if heat is not constantly and largely applied. Mr. Mackworth, already quoted, states that "the average effect of one pound of coal may be taken as imparting one degree of heat to 500,000 cubic feet of air," and that "the amount of ventilation produced

by a well constructed furnace, varies in practice from 4,000 to 8,000 cubic feet per minute for each foot in width across the grate bars."* In all cases the amount is as the square root of the difference between the temperatures of the downcast and the upcast shafts; and also, as the square root of *the depth from the surface;* from which it follows, that the higher the relative temperature, and the greater the depth at which the fire is placed, the greater will be the effect; or, otherwise, a furnace will produce double the effect at one hundred fathoms, it would at twenty-five, all other things being equal.

The area of the furnace upcast is an important element in the case. If the velocity of the currents in the downcast and upcast were necessarily equal, it would follow, that the latter must be, in all cases, a great deal larger than the former, because of the expanded volume of the escaping air; but, inasmuch as the velocity increases equally with the expansion, it is found, that extra area is not required. Indeed Mr. Hedley and Mr. T. J. Taylor say they have contracted the upcast to two-thirds of the area of the downcast without sensible diminution of the quantity circulated.

This is partly accounted for by the cooling action of the sides of the shaft. It being clear, that if the air heated by the furnace is either condensed by water in the shaft, or has the heat absorbed by the strata of its sides, there will be a corresponding lessening of the current, it follows, not only that upcasts should be well drained, but that a shaft twenty feet in circumference will absorb very much less heat than one of forty feet. Hence it is found, that in a smaller upcast, having the advantage of less cooling surface, and the velocity in it being higher, the air has less time to get cooled. But, even with this arrangement, the loss of heat has been found to average one degree for each ten feet of ascent, even when the velocity was so high as six hundred and ninety feet a minute.

Mr. Ralph Moore, Government Inspector, in his "Ventilation of Mines," suggests twenty feet of sectional area for the upcast; which, with a velocity of 500 feet per minute, would produce a current of 10,000 cubic feet per minute.

In all cases, it is better to have separate shaft space for ventilating purposes, as it is found that the action of the cages in a drawing shaft causes continual fluctuations in the upcast current; and that the average velocity is only 480 to 720 feet per minute, instead of from 1,200 to 1,800 feet per minute as may be obtained when the upcast is clear; a difference which proves that three feet of "air end" is better than a whole drawing shaft, where cages are running, besides preserving the ropes from the action of the heat.

The position of the furnace. From what has been already stated, in reference to its increased power at greater depths, it is clear that, where the circulation requires to be very large, its position should be near the bottom of the upcast shaft.

The greatest drawback to its being placed there is its tendency to set the coal or timber lining of the shaft on fire. Within the last few years, a great many shafts have been thus burned, to the great

*The average of four of the best furnaces in West Virginia, gives 3,200 cubic feet per minute per foot in width of furnace at the grate bars. Mr. Mackworth's figures may be all right for *deep drafts*, but they evidently will not do for *shallow* or *drift mines*.—Veazey.

loss of the proprietors, in plant destroyed and trade deranged; but even more lamentable than this is the loss of life that has sometimes occurred. Thus, a few years ago, about a dozen individuals were suffocated in a pit at Larkhill; and, very recently, several similarly lost their lives in a shale pit at Starlow; which, with others that might be named, convey terrible warnings about the position of ventilating furnaces.

Some authors state that the furnace should be placed at a distance of thirty feet from the shaft, and show it so placed in their illustrations; but Mr. Mackworth's rule of from thirty to forty yards is very much safer. In almost every shaft-fire that has occurred, it has been traced to the proximity of the furnace to the woodwork of the shaft. I have known a shaft ignited by a fire thirty yards distant; and recently, in Ayrshire, one was set on fire by a furnace in a lower seam igniting the coal in another several fathoms above it.. In no case should extra risk be run by having it within twenty-five yards. The plan, which prevails in many places, of building the furnace on the side of the level road, within a few feet of the upcast, is not only very dangerous, but very ineffective in doing the work for which it is erected; for there must either be the nuisance of trap-doors at the shaft, or very little of the current is brought into direct contact with the fire, the rest being only affected by the radiation of heat from the brick work, which is often dangerously great, and the sheet iron funnel conducted into the shaft nearly red hot.

A furnace at the surface is much less effective; but I have no hesitation in recommending it, on account of its entire safety, for all pits whose requirements are within the range of its power, being persuaded that that position if not *scientifically correct*, is the *best otherwise*. At No. 1 pit, Greenhead colliery, a furnace four feet in width, with bars six feet long, and arch three feet in height, was built alongside the boiler, and communicated with the engine chimney. The boiler fireman attended to it regularly during the day, and the engineman at night, in all cases burning dross (slack) instead of coal; and we could easily pass 12,000 cubic feet of air per minute over it, which was amply sufficient for the requirements of our company of one hundred men. In similar collieries, with little fire-damp, it is the custom generally to leave the management of the furnace to the bottomer or roadsman, who goes to it two or three times a day, and heaps a great quantity of coal on to serve for the next few hours, which results in a very unequal current besides often overheating the brickwork, to the great danger, and not unfrequently, the burning of the shaft. The effect of irregular firing is such as to cause the fall of a current between one-seventh and one-fourth of the whole amount circulated; and, hence, because a surface furnace can in general be regularly fired without additional expense, and at any rate is ever in a position for the manager to notice, it will be found that, practically, as good an effect will be produced as by one underground; besides which, it is easy to build a six feet furnace at the top, instead of a four feet one at the bottom, and in most cases the first cost will be found to be less in the former case than in the latter, even if a special chimney

requires to be built for it. Those who have had a shaft fire to extinguish, or to pay for, know how serious a matter it is; and those who have had no such experience will do well to consider the subject in the light of the experience of others.

At the same time, it must be again stated that the surface position is only commendable within the limit given. In other circumstances, it must be placed below, and should have a man constantly in charge of it, not only to secure full advantage of its power, but to lessen the risk which it always involves.

The plan of the furnace. The width of grate-bar surface will naturally depend on the requirements of the case, and the data already given may be taken as a guide.* The relative height of the arch is a debated point among engineers; but it seems clear that the nearer the air is brought to the fire, compatible with sufficient sectional area, the more readily and effectually it will be heated.† The practice of many Scottish managers, of causing the air to pass *through* the fire, by having doors on the mouth of the furnace is quite an erroneous one. Doors are put before a *boiler* fire because it is necessary to prevent a cold current carrying off the heat from the boiler; but the only object of the ventilating furnace being to heat the largest quantity of air, it is clear that it should be made to pass over the fire, not through it, except so much as is naturally drawn under the bars.

It is recommended that the drift beyond the bars should rise towards the shaft at an inclination of not less than 1 in 6.

The sectional area of the drift should *certainly not be less* than that of the furnace; for if the newly expended current must be forced next moment through a more contracted channel, it will only do so by the expenditure of a great deal of power in overcoming the increase of friction.‡

In the erection of the furnace the greatest care should be taken to lessen the risk of fire. The side walls should be fourteen inches thick opposite the bars, with sufficient space for the passage of a part of the current outside them, and also above the arch. When the roof is good, the side walls may be carried up to the roof to support it; but they should have manholes here and there through them for the passage of air to the crown of the arch. Where the roof is bad, it is better to have a double arch and side walls than run the risk of having wooden props and gears in such a situation. The side passages should be large enough to admit of the fireman passing along them, which he should do every day and prevent all accummulations of soot. A brick midwall opposite the mouth of the drift is a necessary precaution, which, coupled with a water supply pipe will make the work as safe as the nature of the furnace will admit of.

II. *The Steam Jet.* The first application of jets of steam near the bottom of the upcast, for the purpose of rarifying the air is due to

*For reasons given in a previous note, I would advise counting on only 3,000 cubic feet of air per minute per foot width of grate.—*Veazey.*

†I would recommend that furnaces be so constructed as to give an area of about four square feet above grate-bars to each foot in width of the furnace, and that the height above the bars be not over four and one-half feet.—*Veazey.*

‡The attention of several mine managers about Wheeling is respectfully called to the foregoing sentence.—*Veazey.*

Mr. Goldsworthy Gurney, who proposed it in 1835, with the object of lessening the dangers incident to furnaces in fiery mines; for it seems clearly proved that many fatal explosions have taken place by the ignition at the furnace fire of the current highly charged with gas; an evil, the prevention of which has of late years been sought by feeding the fire with fresh air, and not allowing the return current to mingle with it till after reaching the shaft. The friends of the jet were enthusiastic about it for a time, and made comparisons between its performance and that of the furnace, anything but favorable to the latter; but the question was finally set at rest by a series of careful and elaborate experiments; which, while proving the value of the jets as a ventilating power, conclusively showed that they were not nearly so effective as the older method. Thus, the furnace gave from 6,080 to 11,065 cubic feet per minute for each pound of coal, while the jets only produced 3,274, or according to the report of the government inspectors, only 1,862. At Hetton colliery the useful effect was only 0.36 horse power out of 20.12; while at Tyne Main it was 2.014 out of 109, or about two per cent. of useful effect; the consumption of fuel by the furnace being only one-eighth of that of the jets for an equal quantity of air.

Still, because there is sometimes spare boiler power, and jets can be easily applied, they are very convenient for ventilating sinking shafts and new pits till a furnace is erected; and Mr. Gurney did very valuable service in suggesting them.

III. *Water Ventilation.* When there is a surplus of pumping power, or a sufficient outlet by a day level, water can be very beneficially applied in promoting ventilation. Thus, Mr. Greenwell, with water from two holes an inch in diameter, falling one hundred and twenty-six yards, obtained 8,394 cubic feet of air per minute; and at Lundhill, after the explosion, they obtained 16,500 cubic feet per minute by the same power; but the objection to it is the softness and humidity it imparts to the air, which render it less healthy for breathing and more destructive to timber.

IV. MECHANICAL VENTILATION.

For a long time there have been efforts made to ventilate mines by machinery, and fans, pumps and exhausters have been brought forward in great variety as rivals to the furnace; but from the simplicity and constancy of its action, coupled with its almost entire immunity from accidental stoppage, the latter has hitherto held its own in the great majority of collieries. During the past few years, however, a large number of fans, and especially Guibal's, have been erected, both in England and Scotland. The first cost is considerably more than that of the furnace, but there is a *great saving in labor and fuel, very much less trouble and danger, and largely increased ventilating power, so that for new collieries the fan is clearly worthy of adoption.*

VENTILATING ARRANGEMENTS.

However roomy the shafts, and adequate the ventilating power employed, the practical benefit to the workmen, and through them

to the proprietor, will be little, unless the arrangements for conducting the air through the workings are carried out systematically, constantly and fully. In fiery mines, the danger arising from neglect incites managers to look well to their arrangements; though even among such, the evidence following explosions too often reveals that precautionary efforts have been allowed to slacken. In non-fiery mines, neglect is much more common; and from false notions of economy, carelessness and recklessness, many are in a state of which proprietors and government inspectors little dream.

The tendency of the current being ever to search out and follow the easiest and shortest passage to the upcast shaft, it must be guided by stoppings, doors and brattice in the direction required, on a definite plan, and always as need requires.

Long ago, it was the universal practice to cause the whole of the air to flow in one stream around the workings. In its course, the deleterious ingredients already described were continually loading it with impurity; and when fire-damp was prevalent, the supply of air which the last served men obtained was not merely extremely noxious, but highly dangerous. The return current was quite commonly seen to explode in long flashes of flame in passing over the furnace; and when the mixture assumed certain proportions, the blazing coals lit a train which, flashing backwards round the workings, carried sudden death to all employed. In other mines, less dangerous in this way, the current dragged its long heavy length slowly along, making the lights burn red and low in the thick hot mist that prevailed, and *keeping a poison cup to every lip, till weariness, headache and asthma brought the work to a close.*

In recent times much of this has passed away; the great current is divided into different streams; and, in the best regulated collieries each set of men have their fresh supply; a result not due so much to increased ventilating power, as to increased *useful performance*, through lessening the "drag" of the mine.

The advantage of "splitting" the current is clearly shown in Mr. Atkinson's paper, already referred to. He shows that, *with a constant ventilating pressure*,

7,288	cubic	feet	in	1	column	will	produce	
66,667	"	"	in	5	equal	and	similar	parts
103,280	"	"	in	10	"	"	"	"
111,421	"	"	in	15	"	"	"	
113,701	"	"	in	20	"	"	"	

And with a *constant ventilating power*,

16,198	cubic	feet	in	1	column	will	produce	
70,844	"	"	in	5	five	equal	and	similar parts.
94,850	"	"	in	10	"	"	"	"
99,772	"	"	in	15	"	"	"	"
101,132	"	"	in	20	"	"	"	"

At the same time, the system of splitting the air must not be carried beyond the point at which the velocity of each branch is adequate for the clearing and sweetening the district through which it must pass.

Permanent stoppings should be of brickwork, not less than nine inches thick, as being not only the most effective, but the cheapest in the end.

Trap-doors must be carefully hung, to shut easily and closely, and so that the full car may not strike the hanging side. Double doors are necessary in special cases; but, whether single or double, they cause considerable trouble, and expense, when near the shafts or in the main roads, for which reasons, they should never be put up in such places, except in unavoidable circumstances. In mines yielding fire-damp, it is especially necessary that all trap-doors be shut at night; and a little of a roadman's time, while seeing to this, is well spent, and may prevent serious evil.

Brattice cloth is useful, but only for very temporary purposes; and except for unsettled long-wall workings, or equally special situations, it should not be employed. As a general rule, the circulation of air in a mine is inversely proportional to the quantity of brattice cloth in use, for the reason that it is often the resource of niggardly or lazy managers.

"*Waste*" *airing*, though not so strictly necessary as "face" airing, should nevertheless be attended to; and no lurking accumulations of fire-damp or choke-damp permitted to gather, into the midst of which a man or boy may either carelessly or inadvertently wander, and be seriously injured or lose his life. With the fresh surface air so abundantly provided, and a sufficiency of which can be conducted with ease, through all ordinary workings, the proprietor or manager, who parsimoniously, carelessly or recklessly neglects to secure it, should be sharply punished, so that the whole trade may no longer be dis-graced by the crimes of a minority.

Measurements and records of ventilation should be kept at all collieries, which may be done daily with very little trouble.

Finally, let managers try to remember that, while efficient ventilation is clearly profitable to their employers, the subject appeals specially to the great neighborly rule, "*As ye would that men should do unto you, so do ye unto them.*" It is comparatively *easy* for you to take a run through the mine in the early morning, when the air is fresh and cool; but it is a *very different thing to sweat and toil there all day in an ever thickening atmosphere.* And instead of the *silence* of the men being a *license for neglect*, or their *complaints an occasion for abuse*, let the subject have your *best and kindest attention.*

FURNACE VERSUS MECHANICAL VENTILATION.

The following chapter on the above subject is taken from a late work by J. A. Ramsey, M. E., entitled: "A Treatise on Ventilating and Working Collieries," published in 1882:

"In taking a retrospect of the last fifteen years, the great improvements made in the mechanical ventilation of mines almost forces one to the conclusion that the days of furnace ventilation of deep mines, or of indeed any which evolve noxious gases, are numbered. The power of the furnace appears to have reached its maximum, whilst that of mechanical ventilation is only in its infancy, yet in effect the latter has already exceeded the best performance of the former.

"The maximum power of a furnace by rarifying the air appears to be about 1,000 cubic feet per minute per foot area of the upcast shaft, with a density of between two and three inches of water-gauge. An objection to the furnace can also be raised in the simple fact that explosive mixtures may pass over the fire. Even where these mixtures can be controlled and discharged into the upcast shaft by dumb drifts there is still very great risk, as the following incidents will prove: At Washington colliery a furnace, which stands about five yards from the bottom of the upcast, (which is about ninety-two fathoms or five hundred and fifty-two feet in depth) was lighted during the time of changing the ventilation from Lemielle's to Guibal's system, when the heat from it burnt the wood packing out of a pulley socket placed on an iron frame within the cupola at the surface. Shortly afterwards, under similar circumstances, sparks from the furnace settled upon a wooden stopping placed about three yards within the arched way leading to the fan case and set fire to it, the furnace being at the time driven to its full power. It will be thus seen that at any place subject to outbursts of gas, it will be unsafe* to discharge the return air into the upcast even by dumb drift, unless the mouth of the drift is at such a distance from the fire as to preclude the possibility of sparks in a state of incandescence reaching it. This distance must be considerably over two hundred yards.

"It is evident that the efficiency of mine ventilation, either by artificial or mechanical means, depends entirely on the power applied. By furnace, less fuel in a deep shaft will give a higher ventilating power than the same quantity will do in one of less depth, but the maximum power can be reached in either case. It is simply a question of power and the quantity of fuel consumed.

"If a colliery ventilated by furnace and requiring the maximum power of rarefaction evolves such a quantity of gas that it must be conducted into the upcast shaft by dumb drift, the system can only be worked under the most imminent risk.

"1st. In the event of a spark in a state ofi neandescence reaching the mixture and exploding it.

"2d. The explosive current entering the shaft at a much lower temperature than the ascending column might easily lead to the formation of a *natural brattice, which once established would soon balance the heavier column of air in the downcast shaft*, and if it did not at once cause an explosion by driving the dangerous mixture down to the furnace it would quickly arrest the general ventilation of the mine and throw the pits working into a state of stagnation. Under

*That sparks in a high state of incandescence will explode gas is confirmed by the Select Committee's Report of 1835.

such a condition it is difficult to conceive how an explosion could be avoided.

"With this conviction the writer submits that it ought to be made compulsory that all collieries evolving gas of an explosive nature in large and dangerous quantities should be provided with the most approved mechanical ventilators. Colliery proprietors would certainly profit by such a course.

"By the introduction of mechanical ventilation into fiery mines, another risk, not often taken into account, would be avoided. Most collieries have a goaf not far distant from the shafts, and it may be known as a rule the edge of this goaf is perfectly free from gas. As to what is above is mere conjecture—probably a large space filled with gas, resting very quietly, rising and falling only very slowly—say a few feet for each inch change of the barometer. With an exceptionally low barometrical pressure a small quantity may ooze out, but as the mercury rises it returns to its normal limits. The mercury in the barometer falls again, and then an extra heavy shot; perhaps one blown out, produces a heavy reverberation or big sound wave; a more than usual concussion is felt far away from where the shot is fired, and the disturbing influence causes the gas nestling in the rookeries of the goaf to burst through the humid stratum upon which it was resting; bouyantly it floats on to the furnace, and as quick as lightning the messenger of death and destruction is let loose, gathering force as it spreads and speeds away."

POWER PREPARED FOR VENTILATION.

W. Wardle, Esq., M. E. and C. C., in his "Reference Book for Colliery Managers," says: "I should prefer a furnace if the shafts were deep—say about four hundred yards; but for shallow shafts and extensive workings I should prefer the fan. My objections to waterfall for ventilation are—the water has to be pumped to the surface again, moreover it dampens the air and rots the timber, also the steam jet does not give an adequate amount of ventilation for the fuel it consumes. The fan will put in circulation a greater quantity of air in proportion to the quantity of fuel consumed than the furnace for a shallow pit, and the ventilation may be considerably increased in cases of emergency by simply increasing the speed of the engine. Taking all things into consideration, I should prefer the fan."

Mr. Warrington W. Smyth, M. A., F. R. S., in his "Rudimentary Treatise on Coal and Coal Mining," says: "In selecting our ventilating power it must be remembered that the great object is to obtain a large volume of air at moderate velocity, and that on this

account most of the simple fans, and certain other classes of machines which have to force the air through insufficient valve room, give it an unnecessary velocity, which, in other words, means increased resistance, or diminished ventilation. Furthermore, that whilst the furnace exerts its fullest advantages in deep and dry upcasts, to which the air travels through roomy airways, the *mechanical ventilators* may be *most properly applied at pits* where *these conditions are reversed.*"

The following table taken from the "Colliery Manager's Pocket Book," published by the "Colliery Guardian," London, shows the economy of the fan, as compared with the furnace, as a ventilating power:

Name of Mine.	System of Ventilation.	Cost per horse power in air per hour.	Coal required per day (24 hrs) to perform above duty.	Coal required per annum to perform the above duty.	Cost of coal per annum
		Cents	Tons.	Tons.	$ c.
Average of six experiments	Furnace	1.17	3.67	1,331	805 25
Tyne Main	Furnace	1.60	3.31	1,216	735 68
Hetton, Durham	Furnace	0.77	1.61	586	354 53
Hetton, Durham	Furnace	0.63	1.31	480	290 40
Average of nine experiments		1.04	2.48	903	546 46
Sacre Madame, Belg	Guibal Fan	0.33	1.03	376	237 48
Pelton, Durham, two experiments	Guibal Fan	0.29	0.89	327	197 84
Staveley, Derbyshire, two experiments	Guibal Fan	0.29	0.90	329	199 05
Trimdon, Durham	Guibal Fan	0.29	0.91	331	200 26
Whitehaven, Cumberland, two experiments	Guibal Fan	0.29	0.89	327	197 84
Elswick, Newcastle	Guibal Fan	0.27	0.87	319	193 00
Homer Hill, Staffordshire, two experiments	Guibal Fan	0.25	0.78	285	172 43
Average of eleven experiments		0.287	0.895	328	199 70

Table I—Giving Situation, etc., of the Mines in the Kanawha District, 1883.

No	Name of the Mine	Operator	Superintendent	Mine Boss	Postoffice	Situation: In What County
1	Jerome City	J. T. Bowyer			Winfield	Putnam
2	Star of Raymond	Marmet Mining Co	G. W. Cawley	John W. Good	Raymond City	Putnam
3	Perfection	Black Band Iron and Coal Co.	C. K. McDermott	James Sullivan	Spring Hill	Kanawha
4	Black Hawk	Morris Williams	Morris Williams	Morris Williams	Charleston	Kanawha
5	Brooks'	M. P. Norman	M. P. Norman	James Norman	Charleston	Kanawha
6	Pioneer No 1	Pioneer Coal Co.	J. J. Lovell	Benjamin Alexander	Malden	Kanawha
7	Pioneer No 2	Pioneer Coal Co.	J. J. Lovell	W. G. McDaniel	Malden	Kanawha
8	Boyce	Campbell's Creek Coal Co	J. E. Dana	J. B. Lewis	Malden	Kanawha
9	Calderwood	Campbell's Creek Coal Co.	J. E. Dana	William Calderwood	Malden	Kanawha
10	Dana Bros No 1	Dana Brothers	Geo. Dana	J. B. Lewis	Malden	Kanawha
11	Dickinson's	J. Quincy Dickson	J. Q. Dickinson	Ham. Thompson	Shrewsbury	Kanawha
12	Ber[illegible]ington	W. S. Carkin	W. S. Carkin	Ed. Jackson	Carkin's	Kanawha
13	Winifrede No 1	Winifrede Coal Co	G. C. Hewett	James Morgan	Winifrede	Kanawha
14	Winifrede No 2	Winifrede Coal Co	G. C. Hewett	James Morgan	Winifrede	Kanawha
15	Macfarlane	Macfarlane Coal Co	G. McFarlane	Mark Foster	Coalmont	Kanawha
16	Reynolds & Sturdevant	Reynolds & Sturdevant	P. Butler Reynolds	George B. Reynolds	Fairfields	Kanawha
17	Stevens C & C Co	Stevens Coal and Coke Co	L. T. Krieger	L. T. Krieger	Fairfields	Kanawha
18	McCarty	McCarty Brothers			Fairfields	Kanawha
19	Coalburgh No 1	Robinson Coal Co	Neil Robinson	Robert Brabbin, sr	Coalburgh	Kanawha
20	Coalburgh No 2	Robinson Coal Co	Neil Robinson	Robert Brabbin, sr.	Coalburgh	Kanawha
21	Connell	Peabody Coal Co	G. W. Connell	James Neylan	Peabody	Kanawha
22	East Bank	Stuart M Buck	S. M Buck	G. W. Poff	Coalburgh	Kanawha
23	Cedar Grove	Cedar Grove Mining Co	J. G. W Tompkins	Benjamin F. Spruce	Cedar Grove	Kanawha
24	Kelly's Creek	Cedar Grove Pure Coal Co	Wm. Coles	John Thompson	Cedar Grove	Kanaw'ha
25	[illegible]ksburg	Wm. Sharpe	Wm. Sharpe	James McKelvie	Hampton	Kanawha
26	Crown Hill No 1	Crown Hill Splint Coal Co	Brewer Smith	E. R. Evans	Paint Creek	Kanawha
27	Crown Hill No 2	Crown Hill Splint Coal Co	Brewer Smith	E. R. Evans	Paint Creek	Kanawha
28	Wacomah	Kanawha Cannel Coal Co	H W. Reynolds	E. J. Dunn	Wacomah	Kanawha
29	Wyoming No 1	Wyoming Manufacturing Co	J. C. Evans	J. C. Evans	Handley	Kanawha
30	Wyoming No 2	Wyoming Manufacturing Co	J. C Evans	J. C. Evans	Handley	Kanawha
31	Kanawha	Kanawha Mining Co	G. L. Drouillard	James Youall	Coal Valley	Kanawha
32	Union	Union Coal Co	F. J. Matts	— Pinkney	Coal Valley	Kanawha
33	Mt. Morris	Mt. Morris Coal Co	Wm Trudgen	William Trudgen	Coal Valley	Kanawha
34	Carvers'	Carver Brothers	Jno. Carver	John Carver	Coal Valley	Fayette
35	Excelsior	M. T. Davis & Co	M. T. Davis	George Frazier	Coal Valley	Fayette
36	Eureka	M. T. Davis & Co	M. T. Davis	George Frazier	Coal Valley	Fayette
37	Straughan	Geo. Straughan	George Straughan	John Straughan	Coal Valley	Fayette
38	Coal Valley	Coal Valley Coal Co	A. Toman	A. Toman	Coal Valley	Fayette
39	Cannel[illegible]	Cannelton Coal Co	Henry Davis	Thomas Elliot	Cannelton	Kanawha
40	[illegible]	Cannelton Coal Co	Henry Davis	Thomas Elliot	Cannelton	Kanawha
41	Crescent	Wm R. Johnson	F. A. Bartlam	T. A. Bartlam	Crescent	Fayette
42	Faulkner's No 1	Frederick Faulkner	F. Faulkner		Frederick	Fayette
43	Faulkner's No 2	Frederick Faulkner	F. Faulkner		Frederick	Fayette
44	Eagle	Wm Wyant	Wm. Wyant	John Bostick	Eagle	Fayette
45	St Clair	The St Clair Co	Wm. Wyant	Thomas Lloyd	Eagle	Fayette
46	Mt Carbon No 1	Great Kanawha Colliery Co	Samuel G. Phillips	William Tamplin, jr.	Mt Carbon	Fayette
47	Mt Carbon No 2	Great Kanawha Colliery Co	Samuel G. Phillips	William Tamplin, jr	Mt Carbon	Fayette
48	Hawk's Nest	Hawk's Nest Coal Co (Limited)	Stevens M Taylor	John Shearer	Ansted	Fayette
49	[illegible]	Joseph Pirrung	Joseph Pirrung	Joseph Pirrung	Hawk's Nest	Fayette
50	[illegible]dle	Reed, Lucas & Co	John D. Jones	John D. Jones	Hawk's Nest	Fayette
51	[illegible]	W. A. Burke & Co	William Hamilton	William Hamilton	Elmo	Fayette
52	[illegible]	Wm. Masters & Son	William Masters	William Stout	Fayette Station	Fayette
53	[illegible]burg	Nuttallburg Coal and Coke Co	W. H. Holland	George Holland	Nuttallburg	Fayette
54	[illegible]'s Creek	Nuttallburg Coal and Coke Co.	W. H. Holland	John Small	Nuttallburg	Fayette
55	Caperton	Wm. Beury, Cooper & Co	John Cooper	William Brown	Caperton	Fayette
56	New River	New River Coke Co	F. Howald	R. B. Hanna	Caperton	Fayette
57	Sewell No 1	Longdale Iron Co	John A. McGuffin	Thomas Burke	Sewell	Fayette
58	Sewell No 2	Longdale Iron Co	John A. McGuffin	Thomas Stead	Sewell	Fayette
59	Fire Creek	Fire Creek Coal and Coke Co	F. Howald	Jenkin Jones	Fire Creek	Fayette
60	Echo	Wm. Beury, Cooper & Co	Joseph Beury	Edward Moran	Fire Creek	Fayette
61	Stone Cliff No 1	Fayette Coal and Coke Co	N. M. Jenkin	George Verrigan	Stone Cliff	Fayette
62	Stone Cliff No 2	Fayette Coal and Coke Co.	N. M. Jenkin	Ed. Toland	Stone Cliff	Fayette
63	Quinnimont	Quinnimont Coal and Iron Co	S. B. Patterson	James Laing	Quinnimont	Fayette

No	Mine	On What Creek: Name	On What Creek: Side	On What River: Name	On What River: Side	Distance From	Distance and Direction of Shipping Point from: Newport News	Point Pleasant	Cincinnati, O
1	Jerome City			Great Kanawha River	South		472½ W	29 E	[illegible] E
2	Star of Raymond	Pocatalico River	West		North	3½	463 W	38½ E	[illegible] E
3	Perfection	Davis	South		South	1 4-10	448½ W	53 E	[illegible] E
4	Black Hawk				North	¼	441 W	61½ E	261½ E
5	Brooks'				North	¼	440¾ W	61¾ E	261¾ E
6	Pioneer No 1	Campbell's	West		North	1	439 3-5 W	63 2-5 E	266 2-5 E
7	Pioneer No 2	Campbell's	West		North	1¼	439 3-5 W	63 2-5 E	266 2-5 E
8	Boyce	Campbell's	West		North	1½	439 3-10 W	63 9-10 E	266 9-10 E
9	Calderwood	Campbell's	East		North	1¾	439 3-10 W	63 9-10 E	266 9-10 E
10	Dana Bros No 1	Campbell's	West		North	1¾	439 W	64 1-5 E	267 1-5 E
11	Dickinson's				North		438 W	65 3-10 E	268 3-10 E
12	Ber[illegible]ington				South		437 W	66 3-10 E	269 3-10 E
13	Winifrede No 1	Field's	West		South	6	431¼ W	72¼ E	275¼ E
14	Winifrede No 2	Field's	West		South	6	431¼ W	72¼ E	[illegible] E
15	Macfarlane				North	½	431 W	[illegible] E	[illegible] E
16	Reynolds & Sturdevant	Cabin	West		South	7½	428⅛ W	75 E	[illegible] E
17	Stevens C & C Co	Cabin	West		South	8½	428⅛ W	75 E	278 E
18	McCarty	Cabin	West		South	8½	428⅛ W	75 E	278 E
19	Coalburgh No 1				South		427½ W	75 6-10 E	278 6-10 E
20	Coalburgh No 2				South		427½ W	75 6-10 E	278 6-10 E
21	Connell				North		426¾ W	76 4-10 E	279 1-10 E
22	East Bank				South	¾	426 W	77 1-10 E	280 1-10 E
23	Cedar Grove				North		426 W	77 2-10 E	280 2-10 E
24	Kelly's Creek	Kelly's	[illegible]		North	½	425 3-5 W	77 6-10 E	280 6-10 E
25	[illegible]ksburg				South		425 2-5 W	77 8-10 E	280 8-10 E
26	Crown Hill No 1				South	¼	423⅞ W	79 3-10 E	[illegible] 3-10 E
27	Crown Hill No 2				South	¼	423⅝ W	79 3-10 E	[illegible] 3-10 E
28	Wacomah	[illegible]	W[illegible]		South	[illegible]	422⅞ W	80 5-10 E	[illegible] 10 E
29	Wyoming No 1				South	⅛	419⅞ W	[illegible] E	286½ E
30	Wyoming No 2				South	¼	419⅞ W	[illegible] E	286½ E
31	Kanawha				South		419 W	81 3-10 E	287 3-10 E
32	Union				South	⅛	418¾ W	81 6-10 E	287 6-10 E
33	Mt. Morris	[illegible]	West		South	3-5	418½ W	81 [illegible] 10 E	[illegible] E
34	Carvers'	Morris	East		South	1	418½ W	81 [illegible] 10 E	287 9-10 E
35	Excelsior	Morris	West		South	1⅛	418½ W	81 9-10 E	[illegible] 10 E
36	Eureka	Morris	East		South	1 7-10	418½ W	81 9-10 E	287 9-10 E
37	Straughan				South	¼	418 W	[illegible] 2-10 E	288 2-10 E
38	Coal Valley				South	¼	417¾ W	[illegible] 10 E	288 [illegible]-10 E
39	Cannel[illegible]			New River	North	¼	417¾ W	86 2-10 E	289 [illegible]-10 E
40	[illegible]				North	¾	417¾ W	86 2-10 E	289 2-10 E
41	Crescent				South		417 W	87 E	290 E
42	Faulkner's No 1				South		416¼ W	87 6-10 E	290 [illegible]-10 E
43	Faulkner's No 2				South		416¼ W	87 6-10 E	290 6-10 E
44	Eagle				South		416 W	87 9-10 E	290 9-10 E
45	St Clair				South		415 2-5 W	88½ E	291½ E
46	Mt Carbon No 1	Armstrong	East		South	1	414 W	89 4-5 E	292 4-5 E
47	Mt Carbon No 2	Armstrong	East		South	1	414 W	89 4-5 E	292 4-5 E
48	Hawk's Nest	Mill	West		North	3¼	399 W	105 E	308 E
49	[illegible]				North		398 W	106 E	309 E
50	[illegible]dle				North		397¼ W	106¼ E	309¼ E
51	[illegible]				North		396⅓ W	107⅓ E	310⅓ E
52	[illegible]				North		394⅓ W	109⅓ E	312⅓ E
53	[illegible]burg				North	¼	392 W	112 E	[illegible] E
54	[illegible]'s Creek	Kee[illegible]	West		North	¼	390¼ W	113¾ E	316¾ E
55	Caperton				North		390 W	114 E	317 E
56	New River				North		390 W	114 E	317 E
57	Sewell No 1				North	¼	387⅓ W	116⅓ E	319⅓ E
58	Sewell No 2				North	⅛	387 1-5 W	116 4-5 E	319 [illegible] E
59	Fire Creek	Fire	West		North	1	385 W	119 E	322 E
60	Echo				North		383½ W	120½ E	323½ E
61	Stone Cliff No 1				North	½	379¾ W	121¼ E	327¼ E
62	Stone Cliff No 2				North	1	379⅔ W	124⅓ E	327⅓ E
63	Quinnimont	Laurel	East		South	1½	[illegible] W	131¼ E	337¼ E

No	Mine	Kind of: Mine	Kind of: Coal	Name of Coal Seam	Thickness of Coal: Total	Thickness of Coal: Worked	Elevation of Floor of Mine at Entrance, above: Low Water of River	Railroad Track	Mean Tide	Elevations above Tide, at Shipping Point of: Low Water of River	R. R. track
1	Jerome City	Slope	Block	Pittsburgh	[illegible] 0"	4' 6"	20[illegible]		517 (?)	27 (?)	—
2	Star of Raymond	Drift	Block	Pittsburgh	8' 6"	3' 8"	120 (?)		[illegible]	[illegible]	
3	Perfection	Drift	Block		[illegible] 0"	3' 0"	[illegible]	131	108[illegible]	515	[illegible]
4	Black Hawk	Drift	Block		[illegible] 6"	3' 6"				556	
5	Brooks'	Drift	Block		[illegible] 6"	3' 6"				556	
6	Pioneer No 1	Slope	Block	Campbell's Creek	[illegible] 7"	5' 7"				556	
7	Pioneer No 2	Slope	Block	Campbell's Creek	[illegible] 4"	5' 4"				556	
8	Boyce	Slope	Block	Campbell's Creek	[illegible] 0"	[illegible] 0"				[illegible]	
9	Calderwood	Drift	Block	Campbell's Creek	4' 0"	4' 0"				[illegible]	
10	Dana Bros No 1	Slope	Block	Campbell's Creek	[illegible] 6"	4' 6"				[illegible]	
11	Dickinson's	Drift	Block	Campbell's Creek	[illegible] 0"	4' [illegible]				[illegible]	
12	Ber[illegible]ington	Drift	Block	Campbell's Creek	2' 9"	2' 9"	[illegible]	[illegible]	[illegible]		[illegible]
13	Winifrede No 1	Drift	Splint	Winifrede	5' 0"	5' 0"	[illegible]	[illegible]	[illegible]	[illegible]	634
14	Winifrede No 2	Drift	Splint	Winifrede	5' 0"	5' 0"	[illegible]	[illegible]	[illegible]	[illegible]	14
15	Macfarlane	Drift	Block	Winifrede (?)	[illegible] 0"	4' 0"				[illegible]	
16	Reynolds & Sturdevant	Drift	Splint	Stockton	5' 8"	3' [illegible]	[illegible]	648	[illegible]		[illegible]
17	Stevens C & C Co	Drift	Splint	Winifrede	[illegible] 4"	4' [illegible]	[illegible]	411 (?)	[illegible]		614
18	McCarty	Drift	Splint	Winifrede	4' 4"	4' 4"	[illegible]	111	1025		[illegible]
19	Coalburgh No 1	Drift	Splint	Coalburgh	[illegible] 0"	4' 0"	[illegible]	[illegible]	[illegible]		[illegible]
20	Coalburgh No 2	Drift	Splint	Coalburgh	[illegible] 0"	4' 0"	600	110	[illegible]		[illegible]
21	Connell	Drift	Splint	Coalburgh	[illegible] 0"	4' [illegible]	[illegible]		[illegible]		
22	East Bank	Drift	Splint	Coalburgh	4' 4"	4' 4"	[illegible]	[illegible]	[illegible]	[illegible]	22
23	Cedar Grove	Drift		Cedar Grove	[illegible]	[illegible] 2"	171		[illegible]		
24	Kelly's Creek	Drift		Cedar Grove	[illegible] 0"	[illegible] 0"	[illegible]				
25	[illegible]ksburg	Drift		Cedar Grove	[illegible] 6"	3' 0"	[illegible]	[illegible]	[illegible]		618
26	Crown Hill No 1	Drift	Splint	[illegible]	4' 6"	4' 6"	[illegible]	[illegible]	[illegible]		621
27	Crown Hill No 2	Drift	Splint	[illegible]	[illegible] 6"	4' 6"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	Wacomah	Drift	Cannel and Splint	[illegible]	[illegible]	3' [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	Wyoming No 1	Drift	Gas	[illegible] Valley	4' 0"	4' [illegible]	[illegible]		604	[illegible]	[illegible]
30	Wyoming No 2	Drift	Splint	[illegible]	[illegible] 0"	4' [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	Kanawha	Drift	Splint	[illegible]	[illegible] 0"	4' 0"	[illegible]	110	[illegible]	[illegible]	[illegible]
32	Union	Drift	Gas	[illegible] Valley	[illegible] 0"	5' [illegible]	[illegible]	90	[illegible]	[illegible]	[illegible]
33	Mt. Morris	Drift	Gas	[illegible] Valley	[illegible] 9"	[illegible] 9"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
34	Carvers'	Drift	Gas	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
35	Excelsior	Drift	Gas	[illegible] Valley	[illegible] 0"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36	Eureka	Drift	Gas	[illegible] Valley	[illegible] 0"	[illegible] 6"	[illegible]	[illegible]	[illegible]	[illegible]	
37	Straughan	Drift	Gas	[illegible] Valley	[illegible] 0"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
38	Coal Valley	Drift	Gas	[illegible] Valley	[illegible]	3' [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39	Cannel[illegible]	Drift	Splint and [illegible]	Stockton	1' 1"-7' 6"	[illegible] 0"	[illegible]			[illegible]	[illegible]
40	[illegible]	Drift	Gas	[illegible]	[illegible] 6"	5' [illegible]	[illegible]				[illegible]
41	Crescent	Drift	Gas	[illegible] Valley	[illegible]	5' 6"	[illegible]				
42	Faulkner's No 1	Drift	Coking	[illegible]	4' [illegible]	4' [illegible]	[illegible]				
43	Faulkner's No 2	Drift	Gas	[illegible] Valley	[illegible]	[illegible] 0"		[illegible]			
44	Eagle	Drift	Coking	[illegible]	[illegible] 0"	[illegible]	[illegible]	[illegible]			[illegible]
45	St Clair	Drift	Coking	[illegible]	[illegible]	[illegible] 0"		194			
46	Mt Carbon No 1	Drift	Coking	[illegible]	[illegible]	[illegible] 0"		[illegible]			
47	Mt Carbon No 2	Drift	Gas	[illegible] Valley	[illegible]	[illegible] 0"	[illegible]	[illegible]			
48	Hawk's Nest	Drift	Gas and Coking	[illegible] Valley	11' [illegible]	7' 6					
49	[illegible]	Drift	Steam and Coking	[illegible]	[illegible]	[illegible]					
50	[illegible]dle	Drift	Steam and Coking	Nuttallburg	[illegible] 10"	[illegible] 10"					
51	[illegible]	Drift	Steam and Coking	Nuttallburg	[illegible] 0"	[illegible]					
52	[illegible]	Drift	Steam and Coking	[illegible]	[illegible] 4'	[illegible]					
53	[illegible]burg	Drift	Steam and Coking	[illegible]	[illegible] 4'	[illegible]					
54	[illegible]'s Creek	Drift	Steam and Coking	[illegible]	[illegible] 6"						
55	Caperton	Drift	Steam and Coking	Nuttallburg	[illegible] 0"	4'					
56	New River	Drift	Steam and Coking	[illegible]	[illegible]	[illegible] 8"					
57	Sewell No 1	Drift	Steam and Coking	Nuttallburg	[illegible] 6"	[illegible] 6					
58	Sewell No 2	Drift	Steam and Coking	[illegible] Creek							
59	Fire Creek	Drift	Steam and Coking	Fire Creek		[illegible]					
60	Echo	Drift	Steam and Coking	Fire Creek	[illegible]						[illegible]
61	Stone Cliff No 1	Drift	Steam and Coking	Fire Creek		[illegible]		[illegible]	[illegible]		1083
62	Stone Cliff No 2	Drift	Steam and Coking	Nuttallburg	4' [illegible]	4' [illegible]					
63	Quinnimont	Drift	Steam and Coking	Quinnimont	[illegible]						

Table II—Giving Number of Employes, Etc., of the Mines in the Kanawha District, 1883.

No.	NAME OF THE		NUMBER OF INSIDE EMPLOYEES.					Outside Employees	Total Employees	No. of Mules and Horses Inside.	No. of Mules and Horses Outside.	Total No. of Mules and Horses.	No. Coke Ovens.	Mode of Ventilation.	Mode of Drainage.	System of Working.	Reports returned to Inspector.	Maps Furnished Inspector.	Condition of Mine at time of Inspection as to	
	Mine.	Operator.	Miners.	Track-layers.	Door-tenders.	Drivers	Total.												Ventilation.	Drainage.
1	Jerome City	J. T. Bowyer															Yes	No		
2	Star of Raymond	Marmet Mining Co	130	4	14	20	168	10	178	25		25		Furnace	Natural	Double Entry	Yes	Yes	Fair	Fair
3	Perfection	Black Band Iron and Coal Co	30	1			31	10	41				1	Natural	Natural	Double Entry	Yes	Yes	Not Good	Fair
4	Black Hawk	Morris Williams	4				4	1	5	1		1					Yes	No		
5	Brooks	M. P. Norman	12	1		3	16	1	17	2	2	4					Yes	No		
6	Pioneer No 1	Pioneer Coal Co	50	2	2	7	61	4	65	7	1	8		Furnace	Steam Pump	Double and Single	Yes	Yes	Very Bad	Poor
7	Pioneer No. 2	Pioneer Coal Co	100	3	4	14	121	3	124	16	1	17		Furnace	Steam Pump	Double Entry	Yes	Yes	Very Bad	Poor
8	Boyce	Campbell's Creek Coal Co	100	10	5	15	130	5	135	30		30		Furnace	Steam Pump	Double Entry	Yes	Yes	Good	Good
9	Calderwood	Campbell's Creek Coal Co	100	10	5	13	128	44	172	25		25		Furnace	Steam Pump	Double Entry	Yes	Yes	Excellent	Excellent
10	Dana Bro's No. 1	Dana Brothers	98	8	6	10	122	27	149	17		17		Furnace	Steam Pump	Double Entry	Yes	Yes	Not Good	Poor
11	Dickinson's	J. Quincy Dickson	10	1		2	13	2	15	1	1	2					Yes	No		
12	Bennington	W. S. Clarkin	40	1	2	4	47	6	53	7		7		Steam Jets	Steam Syphon	Single Entry	Yes	Yes	Very Bad	Very Bad
13	Winifrede No. 1	Winifrede Coal Co	175	2	4	10	191	9	200	15	2	17		Furnace	Natural	Double Entry	Yes	Yes	Fair	Poor
14	Winifrede No 2	Winifrede Coal Co												Furnace	Natural	Double Entry	Yes	Yes	Fair	Fair
15	Macfarlane	Macfarlane Coal Co	10	1	1	4	16	9	55	4	1	5		Natural	Natural		Yes	No	Poor	Poor
16	Reynolds & Sturdevant	Reynolds & Sturdevant	10	1		1	12	2	14	1		1		Natural	Natural		No	No		
17	Stevens C. & C. Co	Stevens Coal and Coke Co	6			1	7	3	10	1		1		Natural	Natural		Yes	No		
18	McCarty	McCarty Brothers	6			1	7	3	10	1		1		Natural	Natural		No	No		
19	Coalburgh No. 1	Robinson Coal Co	145	3	3	20	171	3	204	18	4	22		Natural	Natural	Single and Double	Yes	Yes	Poor	Fair
20	Coalburgh No. 2	Robinson Coal Co												Natural	Syphon	Single and Double	Yes	Yes	Poor	Fair
21	Cannell	Peabody Coal Co	60	2	1	4	68	12	80	4	1	5		Furnace	Natural	Double Entry	Yes	Yes	Good	Perfect
22	East Bank	Stuart M. Buck	40	1	2	6	49	10	59	5	1	6		Furnace	Syphon	Single and Double	Yes	Yes	Fair	Fair
23	Cedar Grove	Cedar Grove Mining Co	35	1		3	39	6	45	3		3		Furnace	Syphon	Single and Double	Yes	No	Fair	Fair
24	Kelly's Creek	Cedar Grove Pure Coal Co												Furnace	Natural	Double Entry	No	No	Tolerable	Fair
25	Blacksburg	Wm. Sharpe												Furnace	Syphon	Double and Single	No	No	Tolerable	Fair
26	Crown Hill No 1	Crown Hill Splint Coal Co	80	1	4	6	91	20	111	4	2	6		Natural	Natural	Single and Double	Yes	Yes	Very Bad	Not Good
27	Crown Hill No. 2	Crown Hill Splint Coal Co												Furnace	Natural	Double Entry	Yes	Yes		
28	Wacoma	Kanawha Cannel Coal Co	30	1		4	35	20	55	4	1	5		Furnace	Syphon	Single Entry	Yes	Yes	Poor	Fair
29	Wyoming No. 1	Wyoming Manufacturing Co	12	2		2	16	3	19	2		2		Natural	Syphon	Single Entry	Yes	Yes	Very Bad	Very Bad
30	Wyoming No. 2	Wyoming Manufacturing Co												Natural	Natural	Single Entry	No	No		
31	Kanawha	Kanawha Mining Co	80	2	4	7	102	10	112	7		7		Furnace	Natural	Single Entry	Yes	Yes	Very Bad	Fair
32	Union	Union Coal Co	50	1	1	4	56	8	64	4		4		Furnace	Natural	Single Entry	Yes	Yes	Very Bad	Very Bad
33	Mt. Morris	Mt. Morris Coal Co	45	1	2	6	54	7	61	7		7		Natural	Natural	Single Entry	Yes	Yes	Very Bad	Not Good
34	Carves	Carves Brothers	45	1	2	6	54	8	62	6		6		Fire-basket	Natural	Single and Double	Yes	Yes	Fair	Good
35	Excelsior	M. T. Davis & Co	30	1	1	2	34	5	39	2		2		Furnace	Natural	Single and Double	Yes	Yes	Fair	Fair
36	Eureka	M. T. Davis & Co	50	1	1	5	57	6	63	5		5		Natural	Natural	Single Entry	Yes	Yes	Poor	Fair
37	Straughan's	Geo. Straughan	65	1		6	72	6	78	6	1	7	12	Furnace	Natural	Single Entry	No	No	Tolerable	Not Good
38	Coal Valley	Coal Valley Coal Co	40	2	1	5	48	9	57	5		5		Natural	Natural	Single Entry	Yes	Yes	Fair	Fair
39	Cannel	Cannelton Coal Co	100	2	3	9	114	25	139	10		10		Natural	Natural	Single Entry	No	Yes	Fair	Not Good
40	Block	Cannelton Coal Co	10			1	11			1		1		Natural	Natural	Double Entry	No	Yes	Fair	Not Good
41	Peasent	Wm. R. Johnson	100	4	1	12	117	15	132	16		16		Natural	Natural	Single and Double	Yes	Yes	Not Good	Bad
42	Faulkner's No. 1	Frederick Faulkner		1	2		3	2		2		2		Natural	Natural		Yes	No		
43	Faulkner's No. 2	Frederick Faulkner		1	2		3	2		2		2		Natural	Natural		Yes	Yes	Very Poor	Bad
44	Eagle	Wm. Wyant	70	1	2	8	81	8	89	8		8		Natural	Natural	Single and Double	Yes	Yes	Not Good	Not Good
45	St. Clair	The St. Clair Co	125	2	3	13	143	20	163	18	2	20	24	Furnace	Natural	Single and Double	Yes	Yes	Not Good	Not Good
46	Mt. Carbon No. 1	Great Kanawha Colliery Co	35		1	2	38	16	54	2	1	3	30	Furnace	Natural	Double Entry	Yes	Yes	Not Good	Not Good
47	Mt. Carbon No. 2	Great Kanawha Colliery Co												Natural	Natural	Double Entry	No	Yes		
48	Hawk's Nest	Hawk's Nest Coal Co. (Limited)	75	3	1	8	87	75	162	13	2	15	80	Furnace	Steam Pump	Single Entry	Yes	Yes	Not Good	Very Bad
49	Raymont	Joseph Pitrung	30	1	2	3	36	3	39	3		3		Furnace	Natural	Long Wall	Yes	No	Fair	Fair
50	Stumyside	Reed, Lucas & Co	30	1	0	2	33	3	36	2		2		Natural	Natural	Single Entry	Yes	No	Not Good	Not Good
51	Elmo	W. A. Burke & Co	25	1		2	28	3	31	2		2		Natural	Natural	Single Entry	Yes	Yes	Very Bad	Very Bad
52	Fayette	Wm. Masters & Son	40			3	43	2	45	3		3		Natural	Natural	Single Entry	No	Yes	Not Good	Tolerable
53	Nuttallburg	Nuttallburg Coal and Coke Co	30	1	1	5	37	24	61	29	2	31	51	Natural	Natural	Single Entry	Yes	Yes	Not Good	Tolerable
54	Keeney's Creek	Nuttallburg Coal and Coke Co	30	1	1	3	35	5	40	3		3		Natural	Natural	Single Entry	Yes	Yes	Not Good	Tolerable
55	Caperton	Wm. Beury, Cooper & Co	135	2	3	8	148	19	167	8		8		Natural	Natural	Single and Double	Yes	Yes	Fair	Good
56	New River	New River Coke Co	60	1	1	4	66	7	73	6		6		Furnace	Natural	Single and Double	Yes	Yes	Fair	Fair
57	Sewell No. 1	Longdale Iron Co	42	2	2	9	55	70	125	8	1	9	120	Natural	Natural	Single and Double	Yes	Yes	Fair	Not Good
58	Sewell No. 2	Longdale Iron Co	4	1		1	6		6	1		1		Natural	Natural		No	No		
59	Fire Creek	Fire Creek Coal and Coke Co	120	4	1	20	145	63	208	15	3	18	60	Natural	Natural	Single and Double	Yes	Yes	Very Bad	Tolerable
60	Echo	Wm. Beury, Cooper & Co	40	1	1	5	47	4	51	5		5		Natural	Natural	Single Entry	Yes	Yes	Not Good	Tolerable
61	Stone Cliff No 1	Fayette Coal and Coke Co	12	1		2	15	3	18	2		2		Natural	Natural	Double Entry	Yes	Yes	Fair	Tolerable
62	Stone Cliff No. 2	Fayette Coal and Coke Co	50	2	1	3	56	12	70	3	2	5		Natural	Natural	Single Entry	Yes	Yes	Fair	Good
63	Quinnimont	Quinnimont Coal and Iron Co	60	2	1	9	71	8	79	8	1	9	105	Natural	Natural	Single and Double	Yes	Yes	Fair	Not Good
	Total		2,962	100	90	329	3,481	681	4,162	377	32	409	543							

Table III—Giving Situation, etc., of the Mines in the Northern District, 1883.

No.	Name of the Mine	Name of the Operator	Name of the Superintendent	Name of the Mine Boss	Name of the Postoffice	Situation: In What County
1	Armstrong	[illegible]	James Little	James Little	Piedmont	Mineral
2	Elk Garden No 1	[illegible] Central and Pittsburgh Railway Co	A. C. Rawlings	William Byers	Elk Garden	Mineral
3	Elk Garden No [illegible]	[illegible] Central and Pittsburgh Railway Co.	A. C. Rawlings	Isaiah Fenton	Elk Garden	Mineral
4	Austen	[illegible] of New York	Charles Jessop	J. M. Whitaker	Austen	Preston
5	Newburg	[illegible]	Lawrence Henry	A. Dunsmore	Newburg	Preston
6	Newburg Shaft	[illegible]	Lawrence Henry		Newburg	Preston
7	Irondale	[illegible]	A. Stransz	G. Brown	Raccoon	Preston
8	Fleming[illegible]	[illegible] Co	A. P. Goedecke	John McDonnell	Flemington	Taylor
9	Tyrconnel	[illegible] Co	John H. Henry	Robert Love	Tyrconnel	Taylor
10	Ocean	[illegible] Land Mining Co	R. D. Wilson	R. D. Wilson	Bridgeport	Harrison
11	Murphy's Run	[illegible]	Oliver W. Smith	Richard Pike	Clarksburg	Harrison
12	Despard	[illegible]	Mead, Lewis	J. Latsteter	Clarksburg	Harrison
13	Harrison County	[illegible] Coal & Coke Co	John Corpening	John Corpening	Clarksburg	Harrison
14	Pinnickinnick	[illegible]	James Clifford		Clarksburg	Harrison
15	Patton's	[illegible]	Luther Patton	Luther Patton	Clarksburg	Harrison
16	Farland's	[illegible]	C. I. Farland		Clarksburg	Harrison
17	Wilsonburg	[illegible] Coal Co	John Temple	John Temple	Wilsonburg	Harrison
18	Wolf's Summit	[illegible]	Patrick Dolan	Patrick Dolan	Wolf's Summit	Harrison
19	Volcano	[illegible]	M. Beane	M. Peane	Volcano	Wood
20	O'Brien's	[illegible]	John O'Brien	John O Brien	Volcano	Wood
21	Pew & Co's	[illegible]			Volcano	Wood
22	Ritchie	[illegible]	M. Beane	M. Beane	Volcano	Ritchie
23	[illegible]ston	[illegible]	J. Ed. Watson	George H. Richardson	Fairmont	Marion
24	Palatine	[illegible]	Morgan D. Ott	Morgan D. Ott	Palatine	Marion
25	Central	[illegible]	Oliver Jackson	Samuel Ellis	Fairmont	Marion
26	Fairmont Shaft	[illegible] County Consolidated Co	William Rannie	William Rannie	Fairmont	Marion
27	Moundsville Shaft	[illegible]	William Blake	William Brooks	Moundsville	Marshall
28	Benwood Iron Works	[illegible]	Alonzo Loring	Joseph Huch	Wheeling	Marshall
29	Benwood Coal Works	[illegible]	A. & O. McMechen	Shepherd Hoyt	Benwood	Marshall
30	August Shad's	[illegible]	August Shad	August Shad	Benwood	Marshall
31	Henry Mason's	[illegible]	Henry Mason	Henry Mason	Benwood	Marshall
32	Boggs Run	[illegible] Manufacturing Co	Philip Kunz	Philip Kunz	Wheeling	Marshall
33	Michael Bell's	[illegible]	Michael Bell	Michael Bell	Wheeling	Ohio
34	Richietown	[illegible]	C. R. Brooks	J. W. Brooks	Wheeling	Ohio
35	South Side	[illegible]	C. R. Brooks	William Her[illegible]	Wheeling	Ohio
36	LaBelle	[illegible]	A. Robinson	Christian Baker	Wheeling	Ohio
37	Lancaster & Hercules	[illegible]			Wheeling	Ohio
38	Riverside	[illegible]	Frank J. [illegible]	Lewis Schan	Wheeling	Ohio
39	Belmont	[illegible]	[illegible] Du Bois	L. Barum	Wheeling	Ohio
40	Crescent	[illegible]	C. R. Brooks	Thomas Kasley	Wheeling	Ohio
41	Whitaker	[illegible]	Nelson Whitaker	Thomas Kasley	Wheeling	Ohio
42	Manchester No. 1	Manchester [illegible]	C. L. Kimberly	James Young	Wheeling	Ohio
43	[illegible]	[illegible]			Wheeling	Ohio
44	Central [illegible]	[illegible]	[illegible] Schwannenberger	[illegible] Schwannenberger	Wheeling	Ohio
45	Fulton	[illegible]	J. W. Marshall	J. W. Marshall	Wheeling	Ohio
46	Manchester No 2	Manchester [illegible]	C. L. Kimberly		Wheeling	Ohio
47	Elm Grove Shaft	[illegible]	[illegible] Chambers	Frank Martin	Elm Grove	Ohio
48	Stratton's	[illegible]	John Stratton	John Stratton	Triadelphia	Ohio
49	Newman's	[illegible]	L. Newman	L. Newman	Triadelphia	Ohio
50	Top Mill	Wheeling Iron [illegible]	H. H. Hornbrook	Joseph M. Hamilton	Wheeling	Ohio
51	Stockton	[illegible]	J. W. Marshall	J. W. Marshall	Wheeling	Ohio
52	Bowman's				Wellsburg	Brooke
53	Wellsburg	[illegible]	William Forbs	J. W. Carmichael	Wellsburg	Brooke
54	Wellsburg Shaft	[illegible]	C. Cram	J. C. Cram	Wellsburg	Brooke
55	New Haven	New Haven [illegible] Co	[illegible]	Felix Thomas	New Haven	Mason
56	Hartford City	Hartford City [illegible] Co	C. W. Moredock	Thomas Jones	Hartford City	Mason
57	Califor[illegible]	Charles Ju[illegible]	William Juhling	R. Turnbull	Hartford City	Mason
58	Se[illegible]	[illegible]	A. Bettinger	Peter Bettinger	Hartford City	Mason
59	Mus[illegible]	[illegible]	Charles Clifton	Samuel Hope	Hartford City	Mason
60	German [illegible]	[illegible]	John Mees	Charles Young	Mason City	Mason
61	Hope Furnace	Hope Manufacturing [illegible] Co	Edward Edwards	Edward Edwards	Mason City	Mason
62	Hunter's	William Gent	William Gluver	William Genter	Mason City	Mason
63	Roads'	John Roads	John Roads	John Roads	Mason City	Mason
64	Sterling				Clifton	Mason
65	Clifton Furnace	[illegible] Manufacturing Co	B. Redmond	Owen Curtis	Clifton	Mason
66	Clifton Rolling Mill	Standard Nail and Iron Co	Charles Green	Thomas Headley	Middleport, Ohio	Mason
67	Camden	Consolidated Coal and Mining Co	Willard H. Fogel	John Gosney	West Columbia	Mason

No.	On What Creek: Name	On What Creek: Side	On What River: Name	On What River: Side	Dist.	Distance from Baltimore, by B. & O. R. R.		Distance from Parkersbu'g by B. & O. R. R.		Distance from Cincinnati, by Ohio River	
1			North branch of the Potomac	East	1	215	W	187	E	135	E
2		South		East	2	220	W	192	E	476	E
3		South		East	1	219	W	191	E	475	E
4	Raccoon	South	Tygart Valley	East		263½	W	120½	E	404½	E
5	Raccoon	South		East		[illegible]	W	117	E	391	E
6	Raccoon	South		East		[illegible]	W	117	E	391	E
7	Three Fork	East		East		[illegible]	W	115	E	[illegible]	E
8	Simpson	North	West fork of the Monongahela	East		[illegible]	W	91¼	E	[illegible]	E
9	Simpson	South		East		[illegible]	W	92¼	E	[illegible]	E
10	Simpson	South		East		[illegible]	W	85	E	[illegible]	E
11	Elk	East		East		[illegible]	W	81	E	368	E
12	Elk	East		East		[illegible]	W	83½	E	367½	E
13	Elk	East		East		[illegible]	W	[illegible]	E	[illegible]	E
14	Elk	East		East		[illegible]	W	[illegible]	E	[illegible]	E
15	Elk	East		East		[illegible]	W	81¼	E	[illegible]	E
16				West		[illegible]	W	80	E	[illegible]	E
17				West		[illegible]	W	78¼	E	[illegible]	E
18				West		[illegible]	W	71½	E	[illegible]	E
19			Little Kanawha	North		[illegible]	W	29	E	391	E
20				North		[illegible]	W	23	E	[illegible]	E
21				North		[illegible]	W	29	E	[illegible]	E
22				North		[illegible]	W	20	E	391	E
23			W. Fk. Monon.	North		[illegible]	W	125¼	E	409¼	E
24			Monongah'a	East		[illegible]	W	121	E	408	E
25				West		[illegible]	W	127½	E	411½	E
26	Buffalo	South		West		[illegible]	W	128	E	412	E
27			Ohio	East		[illegible]	W			[illegible]	E
28			Ohio	East		[illegible]	W			[illegible]	E
29			Ohio	East		[illegible]	W			[illegible]	E
30			Ohio	East		[illegible]	W			[illegible]	E
31	Bogg's Run	South	Ohio	East		[illegible]	W			[illegible]	E
32	Bogg's Run	North	Ohio	East		[illegible]	W			[illegible]	E
33			Ohio	East		[illegible]	W			[illegible]	E
34			Ohio	East		[illegible]	W			[illegible]	E
35			Ohio	East		[illegible]	W			[illegible]	E
36			Ohio	East		[illegible]	W			[illegible]	E
37			Ohio	East		[illegible]	W			[illegible]	E
38			Ohio	East		[illegible]	W			[illegible]	E
39			Ohio	East		[illegible]	W			[illegible]	E
40	Wheeling	South	Ohio	East		[illegible]	W			[illegible]	E
41	Wheeling	South	Ohio	East		[illegible]	W			[illegible]	E
42	Wheeling	South	Ohio	East		[illegible]	W			[illegible]	E
43	Wheeling	South	Ohio	East		[illegible]	W			[illegible]	E
44	Wheeling	South	Ohio	East		[illegible]	W			[illegible]	E
45	Wheeling	North	Ohio	East		389	W			[illegible]	E
46	Wheeling	South	Ohio	East		381	W			[illegible]	E
47	Wheeling	North	Ohio	East		[illegible]	W			[illegible]	E
48	Wheeling		Ohio	East		[illegible]	W			[illegible]	E
49	Wheeling		Ohio	East		[illegible]	W			[illegible]	E
50			Ohio	East		380½	W			378¾	E
51			Ohio	East		[illegible]	W			[illegible]	E
52			Ohio	East		[illegible]	W			[illegible]	E
53			Ohio	East		391¼	W			392¼	E
54			Ohio	East		[illegible]	W			[illegible]	E
55			Ohio	East						[illegible]	E
56			Ohio	East						[illegible]	E
57			Ohio	East						[illegible]	E
58			Ohio	East						[illegible]	E
59			Ohio	East						[illegible]	E
60			Ohio	East						[illegible]	E
61			Ohio	East						[illegible]	E
62			Ohio	East						238¾	E
63			Ohio	East						218½	E
64			Ohio	East						219	E
65			Ohio	East						218	E
66			Ohio	East						217½	E
67			Ohio	East						215	E

No.	Kind of Mine	Kind of Coal	Name of Coal Seam	Thickness of Coal: Total	Thickness of Coal: Worked	Elevation of Floor of Mine Entrance above Low Water of River	Elevation above B & O R R Track	Elevation above Tide	Elevations Above Tide, at Shipping Point of Low Water of River	Elevations Above Tide, at Shipping Point of B & O R R track
1	Drift	Semi Bituminous.	Big Vein of Geo's creek, Md	11' [illegible]	11' [illegible]		[illegible]	[illegible]		[illegible]
2	Drift			12' [illegible]	[illegible]		[illegible]	[illegible]		[illegible]
3	Drift			12' [illegible]	[illegible]		[illegible]	[illegible]		[illegible]
4	Drift	Coking	Austen	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
5	Drift	Gas	Pittsburgh	[illegible]	8' [illegible]		[illegible]	[illegible]		[illegible]
6	Shaft	Gas		[illegible]			[illegible]	[illegible]		[illegible]
7	Slope	Coking and Gas		[illegible]	4'					
8	Drift	Gas	Pittsburgh	[illegible]	7' [illegible]		[illegible]	[illegible]		1029
9	Drift	Gas	Pittsburgh	[illegible]	8' 0"		[illegible]	[illegible]		[illegible]
10	Drift	Gas	Pittsburgh	[illegible]	7' 9"		[illegible]	[illegible]		[illegible]
11	Drift	Gas	Pittsburgh	[illegible]	8' [illegible]		[illegible]	[illegible]		[illegible]
12	Drift	Gas	Pittsburgh	[illegible]	8' [illegible]		[illegible]	[illegible]		[illegible]
13	Drift	Gas	Pittsburgh	[illegible]	8' 6"		[illegible]	[illegible]		[illegible]
14	Drift	Gas	Pittsburgh	[illegible]	8' [illegible]		[illegible]	[illegible]		[illegible]
15	Drift	Gas	Pittsburgh	[illegible]	8' [illegible]		[illegible]	[illegible]		1030
16	Drift	Gas	Pittsburgh	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
17	Drift	Gas	Pittsburgh		[illegible]		[illegible]	[illegible]		[illegible]
18	Drift	Gas	Pittsburgh							
19	Drift	Gas		[illegible]	4'					
20	Drift	Gas								
21	Drift	Gas								
22	Drift	Gas		4'	4'					
23	Drift	Gas	Pittsburgh	[illegible]	[illegible]		[illegible]	[illegible]		77
24	Drift	Gas	Pittsburgh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	77
25	Drift	Gas	Pittsburgh	[illegible]	[illegible]		[illegible]	[illegible]		871
26	Shaft	Gas	Pittsburgh	[illegible]			[illegible]	[illegible]		871
27	Shaft	Gas	Pittsburgh			[illegible]	[illegible]	49[illegible]	[illegible]	648
28	Drift	Gas	Pittsburgh			[illegible]	8[illegible]	610	[illegible]	648
29	Drift	Gas	Pittsburgh	[illegible]	[illegible]		151	[illegible]	[illegible]	648
30	Drift	Gas	Pittsburgh				[illegible]	[illegible]	[illegible]	648
31	Drift	Gas	Pittsburgh				[illegible]	[illegible]	[illegible]	646
32	Drift	Gas	Pittsburgh				[illegible]	[illegible]	[illegible]	646
33	Drift	Gas	Pittsburgh					[illegible]	[illegible]	646
34	Drift	Gas	Pittsburgh					[illegible]	[illegible]	646
35	Drift	Gas	Pittsburgh					[illegible]	[illegible]	646
36	Drift	Gas	Pittsburgh					[illegible]	[illegible]	645
37	Drift	Gas	Pittsburgh					[illegible]	[illegible]	645
38	Drift	Gas	Pittsburgh					[illegible]	[illegible]	645
39	Drift	Gas	Pittsburgh					[illegible]	[illegible]	[illegible]
40	Drift	Gas	Pittsburgh					[illegible]	[illegible]	
41	Drift	Gas	Pittsburgh					[illegible]		
42	Drift	Gas	Pittsburgh					[illegible]		
43	Drift	Gas	Pittsburgh					[illegible]	[illegible]	
44	Drift	Gas	Pittsburgh					[illegible]	[illegible]	
45	Drift	Gas	Pittsburgh			[illegible]			[illegible]	
46	Drift	Gas	Pittsburgh							
47	Shaft	Gas	Pittsburgh							
48	Drift	Gas								
49	Drift	Gas								
50	Drift	Gas	[illegible]			[illegible]		[illegible]	[illegible]	
51	Drift	Gas	Pittsburgh					[illegible]		
52	Drift	Gas	Pittsburgh			[illegible]		[illegible]		
53	Drift	Gas	Pittsburgh						[illegible]	
54	Shaft	Coking and Gas						[illegible]		
55	Slope	Gas	[illegible]							
56	Slope	Gas	[illegible]						[illegible]	
57	Drift	Gas	[illegible]	4	4			[illegible]		
58	Drift	Gas	[illegible]	4' [illegible]	[illegible]	[illegible]		[illegible]		
59	Drift	Gas	[illegible]	4	4'			[illegible]		
60	Drift	Gas	[illegible]	4' [illegible]	4	[illegible]		[illegible]		
61	Drift	Gas	[illegible]	4'				[illegible]	[illegible]	
62	Drift	Gas	[illegible]	4	4			[illegible]		
63	Drift	Gas	[illegible]	4		[illegible]		[illegible]	[illegible]	
64	Drift	Gas	[illegible]	4						
65	Drift	Gas	[illegible]	4'	4	[illegible]		[illegible]		
66	Drift	Gas	[illegible]	4'	4'	[illegible]		[illegible]		
67	Drift	Gas	[illegible]	4'	4'	[illegible]		[illegible]		

Table IV—Giving Number of Employes, Etc., of the Mines in the Northern District, 1883.

No.	Name of the Mine.	Operator.	Number of Inside Employes. Miners.	Track layers.	Door tenders.	Drivers.	Total.	Outside Employes.	Total Employes.	No. of Mules and Horses Inside.	No. of Mules and Horses Outside.	Total No. of Mules and Horses.	No. Coke Ovens.	Mode of Ventilation.	Mode of Drainage.	System of Working.	Reports returned to Inspector.	Maps Furnished Inspector.	Condition of Mine at time of Inspection as to Ventilation.	Condition of Mine at time of Inspection as to Drainage.
1	Armstrong	Big Vein Coal Co	75	2		7	84	11	95	6	1	7		Natural	Syphon	Single Entry	Yes	Yes	Fair	Fair.
2	Elk Garden No. 1	West Virginia Central and Pittsburgh Railway Co	219	7		20	242	90	332	24		24		Natural	Natural	Single and Double	Yes	Yes	Fair	Fair.
3	Elk Garden No. 2	West Virginia Central and Pittsburgh Railway Co												Natural	Natural	Single Entry	Yes	Yes	Tolerable	Fair.
4	Austen	Colgate & Co., of New York	20	2	1	7	30	20	50	11	1	12	50	Natural	Natural	Single and Double	Yes	Yes	Fair	Good
5	Newburg	Newburg Orrel Coal Co	60	3		8	71	42	113	11	2	16	33	Natural	Natural	Single Entry	Yes	Yes	Fair	Tolerable
6	Newburg Shaft	Newburg Orrel Coal Co														Steam Pump				
7	Irondale	I. Nemegyei	81	1		6	88	2	90	4	1	5	52	Natural	Steam Pump		Yes	No	Fair	Good
8	Flemington	Taylor County Coal Co	40	2		5	47	4	51	5	1	6		Natural	Natural		No	No	Not Good	Poor
9	Tyrconnel	Newburg Orrel Coal Co	45			3	48	5	53	9		9	25	Natural	Natural	Single Entry	Yes	Yes	Fair	Fair
10	Ocean	Consolidated Coal and Mining Co	30	1		5	36	1	40	5		5		Natural	Natural	Single Entry	Yes	Yes	Poor	Very Bad
11	Murphy's Run	Heirs of Burr Wakeman	38			10	48	5	53	10		10		Natural	Natural	Single Entry	Yes	Yes	Not Good	Good
12	Despard	Despard Coal Co	60	3		17	80	10	90	16	1	17	18	Natural	Natural	Double Entry	Yes	Yes	Fair	Perfect
13	Harrison County	Harrison County Coal Co	10	1		2	13	3	16	2	1	3	6	Natural	Natural		No	No		
14	Pinnickinick	Jackson & Clilford	6	1		1	8	2	10	2		2		Natural	Natural		No	No		
15	Patton's	Luther Patton	8	1		2	11	3	14	3		3		Natural	Natural		No	No		
16	Farland's	J. T. Farland	7	1		1	9	3	12	1		1	20	Natural	Natural		No	No		
17	Wilsonburg	Monongahela Gas Coal Co	26	1		2	29	4	33	4	1	5	30	Natural	Natural	Single and Double	No	Yes	Very Poor	Fair
18	Wolf's Summit	Patrick Dolan	6	1		1	8	2	10	1		1					No	No		
19	Volcanic	Michael Beane	7	1		1	9	2	11	1		1					No	No		
20	O'Brien's	John O'Brien	9	1		1	11	2	13	1		1					No	No		
21	Pew & Co's	D. C. Pew & Co	4	1		1	6	2	8	1		1					No	No		
22	Ritchie	Michael Beane	7	1		1	9	2	11	1		1					Yes	No	Not Good	
23	Fenton	Fenton Gas Coal Co	61	1		8	69	14	74	7	1	8		Natural	Steam Pump	Single Entry	Yes	Yes	Not Good	Fair
24	Palatine	Newburg Orrel Coal Co	24	1		6	31	6	37	6		6		Natural	Natural	Single Entry	Yes	Yes	Fair	Fair
25	Central	Oliver Jackson	8	1		1	10	2	12	1		1	10	Natural	Natural	Single Entry	No	No	Very Good	Good
26	Fairmount Shaft	W. Fairmount and Marion County Consolidated G. C	30	2	1	4	37	13	50	4		4	12	Natural	Steam Pump	Single and Double	Yes	Yes		
27	Moundsville Shaft	Moundsville Coal Co	6	1		1	8	4	12					Fan	Steam Pump	Double Entry	No	No	Very Good	Good
28	Benwood Iron Works	Benwood Iron Works	36	2		12	50	1	51	12	1	13		Furnace	Natural	Single and Double	Yes	Yes	Very Poor	Fair
29	Benwood Coal Works	W. & O. McMellen	8	1		3	12	3	15	3		3		Furnace	Syphon		Yes	No		
30	August Shaaf's	August Shaaf	5	1		1	7	3	10	1	3	4		Furnace	Natural		No	No		
31	Henry Mason's	Henry Mason	4	1		1	6	1	7	1		1		Natural	Natural		No	No		
32	Boggs' Run	Boggs' Run Mining and Manufacturing Co	17	1		4	22	3	25	4		4		Furnace	Natural		No	No	Very Poor	Fair
33	Michael Bell's	Michael Bell	4	1		1	6	1	7	1		1		Furnace	Natural		No	No		
34	Richlestown	Kasley & Brooks	18	1		5	24	2	26	5		5		Furnace	Natural		Yes	No	Poor	Fair
35	South Side	Kasley & Brooks	8	2		2	12	1	13	2		2		Furnace	Steam Pumps		Yes	No	Poor	Poor
36	LaBelle	La Belle Iron Works	25	1	1	10	37	2	59	10		10		Furnace	Steam Pump	Single Entry	Yes	Yes	Poor	Fair
37	Lancaster & Hercules	Lancaster & Hercules	3	1		1	5	1	6	1		1					No	No		
38	Riverside	Riverside Iron Works	36	5		17	58	6	64	18		18		Furnace	Water Boxes	Single and Double	Yes	Yes	Very Poor	Good
39	Belmont	Belmont Iron Works	26	2		16	44	5	49	15		15		Furnace	Steam Pump	Double Entry	Yes	Yes	Very Poor	Fair
40	Crescent	Kasley & Brooks	11	1		2	13	2	15					Furnace	Natural		Yes	No		
41	Whitaker	Whitaker Iron Co	21	2		3	26	3	29	5		5		Furnace	Natural	Single and Double	Yes	Yes	Not Good	Good
42	Manchester No. 1	Manchester Coal Co	20	1		4	25	1	26	4		4		Furnace	Natural	Single and Double	Yes	Yes	Very Poor	Fair
43	Werner's	Joseph Werner	8	1		1	10	1	11	1		1		Furnace	Natural		Yes	No		
44	Central Glass House	Central Glass Co	10	1		3	14	2	16	2		2		Furnace	Natural		No	No		
45	Fulton	Marshall, Van Fossen & Co	16	1		5	20	2	22	4		4		Natural	Natural	Single Entry	Yes	Yes	Abominable	Abominable
46	Manchester No. 2	Manchester Coal Co	8	1		1	10	1	11	1		1		Natural	Natural	Double Entry	Yes	Yes		
47	Elm Grove Shaft	W. T. Chambers & Co	12	1		1	14	4	18	1		1		Furnace	Steam Syphon	Single Entry	Yes	No	Poor	Fair
48	Stratton's	John Stratton	3			1	4	1	5	1		1					No	No		
49	Newman's	Louis Newman	6			1	7	1	8	1		1					No	No		
50	Top Mill	Wheeling Iron and Nail Co	32	2	1	9	44	4	48	9		9		Furnace	Natural	Single and Double	Yes	Yes	Tolerable	Fair
51	Shackown	Marshall, Van Fossen & Co	8	1		2	11	1	12	2		2		Natural	Natural	Single Entry	Yes	No	Very Poor	Tolerable
52	Bowman's		3			1	4	2	6	1		1					No	No	Poor	Not Good
53	Wellsburg	Forbs, Carmichael & Co	20	1		3	24	5	29	3		3		Furnace	Natural	Single Entry	Yes	No	Very Good	Fair
54	Wellsburg Shaft	S. W. Crawford & Co	9	1		1	11	2	13					Exhaust Steam	Steam Pump		Yes	No	Fair	Not Good
55	New Haven	New Haven Coal and Shipping Co	40	1	6	1	48	8	56	3	2	5		Furnace	Steam Pump		Yes	No		
56	Hartford City	Hartford City Coal and Salt Co	29	1	2	6	42	6	48	6	6	12		Natural	Steam Pump	Single Entry	Yes	No		
57	California	Charles Jolliffe	20	1		4	25	4	29	4		4		Natural	Natural		Yes	No	Tolerable	Bad
58	Schon	C. A. Bettinger & Co	30			7	37	8	45	10	2	12		Natural	Natural		Yes	No	Not Good	Bad
59	Mesquito	Liverpool Salt Co	15	1		3	19	2	21	3	1	4		Furnace	Natural		Yes	No	Tolerable	Bad
60	German Furnace	German Salt and Coal Co	12	1		3	16	1	17	3		3		Natural	Natural		Yes	No		
61	Hope Furnace	Hope Manufacturing and Coal Co	13	1		3	17	1	18	3	2	5		Natural	Natural		Yes	No		
62	Ginter's	William Ginter	4	1		1	6	1	7	1		1					No	No		
63	Roads	John Roads	4	1		1	6	1	7	1		1					No	No		
64	Sterling		20	1		5	26	4	30	5		5					Yes	No	Tolerable	Poor
65	Clifton Furnace	W. Va. & Ohio Mining and Manufacturing Co	18	1	1	5	25	1	26	6	1	7		Furnace	Natural		Yes	Yes	Tolerable	Not Good
66	Clifton Rolling Mill	Standard Salt and Iron Co	46	1		7	54	4	58	9		9		Furnace	Natural		Yes	No	Fair	Not Good
67	Camden	Consolidated Coal and Mining Co	60	1		11	72	10	83	11		11		Furnace	Natural					
	Totals		1,476	84	14	289	1,862	370	2,232	371	29	340	259							

Table V—Giving Number, Nature, etc., of Fatal Accidents in the Kanawha District, 1883.

No.	Date of Accident	Date of Death	Name of Person	Name of Mine	County in Which Mine is	Nature and Cause of Accident
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Killed by mule running away with car [illegible]
2	Feb [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Killed by fall of slate [illegible] close enough to [illegible] he had been ordered by mine boss to do
3	March [illegible]	March [illegible]	[illegible]	[illegible]	[illegible]	Killed by [illegible]
4	April [illegible]	April [illegible]	[illegible]	[illegible]	[illegible]	[illegible] hours after the accident [illegible] caused by his neglect to use [illegible]
5	May [illegible]	May 2	[illegible]	[illegible]	Kanawha	Killed by coal falling on him [illegible] he had fired a shot which [illegible] knocked down the coal
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Killed by fall of coal. [illegible]
7	July [illegible]	July [illegible]	[illegible]	[illegible]	[illegible]	Killed by fall of [illegible]
8	[illegible]	[illegible]	[illegible] Miller	[illegible]	[illegible]	Killed by coal falling on his [illegible] coal under which he was [illegible]
9	[illegible]	[illegible]	[illegible] Mill	[illegible]	[illegible]	Killed by fall of [illegible]
10	[illegible]	[illegible]	[illegible]	[illegible] No. [illegible]	[illegible]	[illegible] warned by the mine boss [illegible] He died [illegible] day
11	[illegible]	[illegible]	[illegible]	[illegible] Nest	[illegible]	Killed [illegible]
12	[illegible]	[illegible]	[illegible]	[illegible] No. 1	Kanawha	These two men were given a room [illegible] track men had taken down a [illegible] of slate which was hanging [illegible] Anderson and Carner began [illegible] on both men, mashing Carner's head and breaking Anderson's neck. [illegible]
13	[illegible]	[illegible]	[illegible]	[illegible] No. [illegible]	Kanawha	

TABLE VI.—Giving Number, Nature, Etc., of Non-Fatal Accidents in the Kanawha District, 1883.

No	Date	Name of Person.	Name of Mine.	County in Which Mine is Situated.	Time Lost on Account of Injury.	NATURE AND CAUSE OF ACCIDENT.
1	February 1st.	Robert House	New River	Fayette		Arm broken by fall of slate which he had been told to prop.
2	February —.	John Patterson	Carver Bro.'s	Fayette		Head cut by fall of coal.
3	May 25th	Benj. Foster	Carver Bro.'s	Fayette.		Leg broken by fall of slate.
4	July 11th	Joseph Carlin	Crescent	Fayette		Foot and ankle mashed by jumping off a mine car which ran over him.
5	August 6th.	Royal Love	Crescent	Fayette.		Body bruised by a lever striking him while putting a mine car on the track
6	August —	John Tasker	Carver Bro.'s	Fayette		Arm and leg broken by falling between mine cars.
7	August —	Pleasant Thomas	Stone Cliff No. 2	Fayette		Ankle sprained by fall of slate
8	August —	John Burton	Stone Cliff No. 2	Fayette		Caught between loaded car and roof and skinned his back.
9	September 13th	F. Quarles	Stone Cliff No 2	Fayette		Coal fell on him causing a slight scalp wound.
10	September 3rd	Andrew Slaughter	Stone Cliff No 2	Fayette		Collar bone broken by slate falling on him.
11	October —	Leonard Holstein	Macfarlane	Kanawha		Fingers cut off and hand mashed by fall of slate in a place where he was pushing a car.
12	December	James Layton	Faulkner's No. 2	Fayette.		Collar bone broken by coal falling on him while mining
13		Buck Gray.	Excelsior	Fayette.		Leg broken by fall of coal.
14		Robt. Odell	Dana Brothers'	Kanawha		Leg broken by car running off the track
15		Isom Lewis	Echo	Fayette		Leg broken by fall of coal.
16			Dickinson's.	Kanawha		
17			Dickinson's	Kanawha.		
18			Kanawha	Kanawha		Hand hurt.

Table VII—Giving Number, Nature, etc., of Fatal Accidents in the Northern District, 1883.

No.	DATE OF Accident	DATE OF Death	Name of Person	Name of Mine	County in which Mine is Situated	NATURE AND CAUSE OF ACCIDENT.
1	January 2	January 12	Frederick Ebeling	Benwood Coal Works	Marshall	Injured by fall of roof. Particulars not given.
2	April	April	John Carney	Elk Garden No. 1	Mineral	Killed by fall of coal at face of room. Crushed in breast.
3	June	June	Ira Potter.	Elk Garden No. 1	Mineral	Was riding between mine cars, bending over, he was caught between the cars and rib and crushed through the hips. He lived four days after the accident.
4	August		William Riley	Armstrong	Mineral	Crushed through head and chest by a fall of coal at face of room. He lived twenty-one days after the accident.
5	September 15	September 20	James Smith	Clifton Furnace	Mason	Died from injuries received by fall of slate caused by his neglecting to prop sufficiently
6	November 9	November 9	Samuel Valentine	Palatine	Marion	Injured by fall of coal which he had neglected to prop, although he had been warned of his danger a few minutes previous by the mine boss, by another miner. He lived two hours after the accident.
7	August 28	August 28	George Ayers	Irondale	Preston	Caught under some fall of slate with Harrison Cook, which they had neglected to prop after being warned by the mine boss. Ayers got out from under the fall and tried to assist Cook, other men came to assist and in the Ayers gone as and sat down. Cook was gotten out in about fifteen minutes when the men went to where Ayers had sat down they found him dead, caused, no doubt by fright, heart affection, no external injuries.

Table VIII—Giving Number, Nature, etc., of Non-Fatal Accidents in the Northern District, 1883.

No.	Date.	Name of Person.	Name of Mine.	Co. in which Mine is.	Time Lost on Account of Injury.	NATURE AND CAUSE OF ACCIDENT.
1	February —	George Richardson	Elk Garden No. 1	Mineral	About six weeks	Crushed by fall of coal in treading. Accident caused by his mining too far under coal without spragging.
2	May —	J. Mallory	Belmont	Ohio	Three weeks	Was bruised by jumping off of mine car while it was in motion.
3	June —	Michael O'Donnel	Belmont	Ohio	Three months	Leg broken by riding on coupling bar between mine cars.
4	July —	Ephraim Harvey	Elk Garden No. 2	Mineral	Three weeks	Caught between mine car and rib and hurt through the hips.
5	August 15th	Caleb Davis	Gaston	Marion	Two weeks	Hurt, by fall of coal, in hips and shoulder. Accident caused by his neglecting to sprag coal under which he was mining and which had been loosened but not knocked down by a shot
6	August	Martin Rooney	Murphy's Run	Harrison		Had his leg hurt by cart upsetting with him outside the mine where some dirt was being removed.
7	October 1st	Andrew Ice	Gaston	Marion	One month	Hurt through the hips by fall of coal under which he was mining without spragging it, though it had been loosened but not knocked down by a shot.
8	November —	George Spiers	Elk Garden No. 1	Mineral	Two weeks	Severe scalp wound from fall of coal at face of room.
9	December —	Theodore Whiters	Crescent	Ohio	Three weeks	Shoulder injured by fall of roof. Particulars not given.
10		Reuben Smith	La Belle	Ohio	Two weeks	Foot mashed by being caught between mine cars.
11	August 28th	Harrison Cool	Irondale	Preston		Caught under fall of roof with George Avers, had both legs broken. Was able to walk on crutches in March, 1884.
12	September 25th	Henry H. Robinson	Fairmont Shaft	Marion	Two months	Ankle bone broken by piece of slate falling and striking him on the knee
13		William Curtis	Whitaker	Ohio	Two months	Arm broken by being caught between a mine car and a post. He was riding on a car and put his hand out against a post, his elbow was caught against the car and his arm broken.